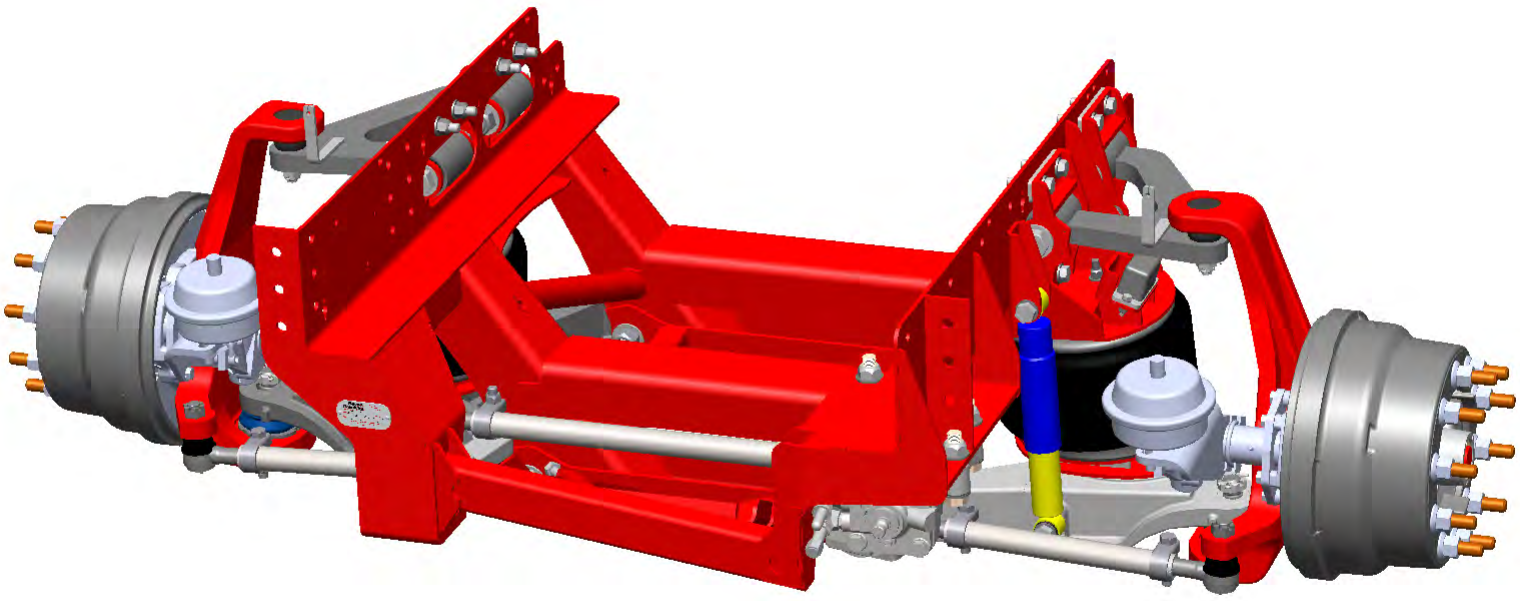
Motorhome Suspensions | Owner's Manual

IFS1000-WF | Independent Front Suspension

Maintenance Instructions
Service Parts



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COMPANY PROFILE

Reyco Granning Suspensions was formed by the merger and acquisition of two well-known names in the heavy-duty vehicle suspension industry: Reyco and Granning.

Reyco grew out of the Reynolds Mfg. Co. and was first known as a major supplier of brake drums for heavy-duty vehicles, and later developed a full line of air and steel spring suspensions for trucks, busses, trailers, and motorhomes.

Granning Air Suspensions was founded in 1949 in Detroit, Michigan as a manufacturer of auxiliary lift axle suspensions. Granning later became an innovator of independent front air suspensions for the motorhome industry.

Reyco Granning LLC was formed in early 2011 through a partnering of senior managers and MAT Capital, a private investment group headquartered in Long Grove, Illinois.

Reyco Granning manufacturing facilities are certified to the ISO9001:2008 standards, a globally recognized assurance that quality standards have been established and are maintained by regular rigorous audits.

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Service Notes

This Service Manual describes the correct service and repair procedures for the ReycoGranning® IFS1000-WF Independent Front Suspension model with 10,000 lb Gross Axle Weight Rating (GAWR). Overloading the suspension may result in adverse ride and handling characteristics.

You must read and understand all procedures and safety precautions presented in this manual before conducting any service work on the suspension.

Proper tools must be used to perform the maintenance and repair procedures in this manual. Some procedures require the use of special tools for safe and correct service. Failure to use the proper and/or special tools when required can cause personal injury and/or damage to suspension components.

You must follow your company safety procedures and use proper safety equipment when you service or repair the suspension.

The information contained in this manual was current at the time of printing and is subject to change without notice or liability. ReycoGranning® reserves the right to modify the suspension and/or procedures and to change specifications at any time without notice and without incurring obligation.

ReycoGranning® uses the following types of notices for potential safety problems and to give information that will prevent damage to equipment.

⚠ WARNING

A warning indicates procedures that must be followed exactly. Serious personal injury can occur if the procedure is not followed.

⚠ CAUTION

A caution indicates procedures that must be followed exactly. Damage to equipment or suspension components and personal injury can occur if the procedure is not followed.

NOTE

A note indicates an operation, procedure or instruction that is important for correct service.

Identification

The suspension model and serial number are stamped on an aluminum tag that is riveted to the front of the suspension sub-frame assembly (**Figure 1**). The serial number is used by ***ReycoGranning***® for control purposes and should be referred to when servicing the suspension or requesting technical support (**Figure 2**).

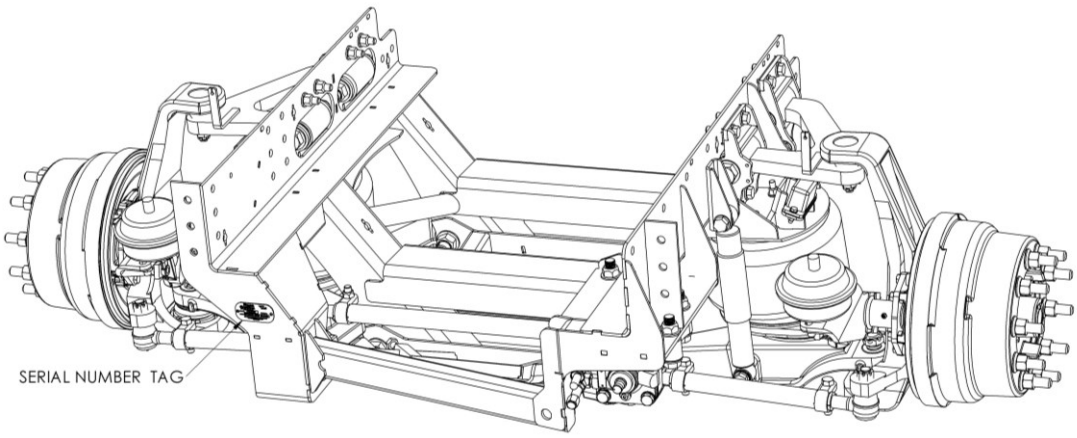


Figure 1 - Suspension Identification Location

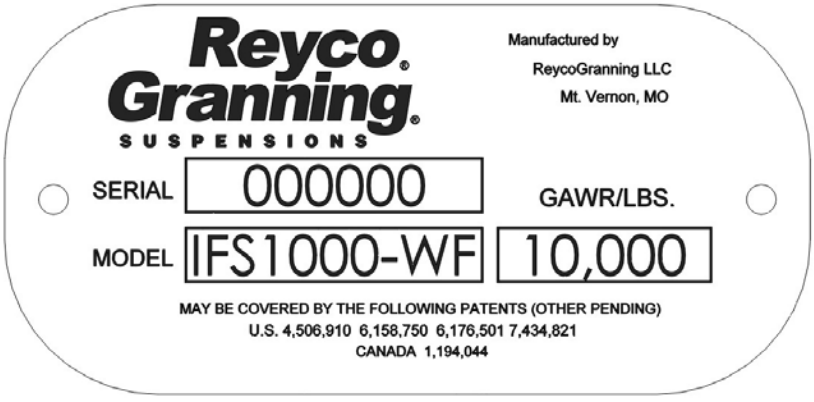


Figure 2 - Suspension Serial Number Tag

Vehicle Towing Information

If a vehicle is disabled and needs to be towed by the front end to service center, check the OEM/Coach Builder towing procedures for the recommended method. Check with local authorities and Department of Transportation (DOT) for permissible towing methods before towing. Some states do not permit towing by chains and/or straps.

The preferred towing apparatus is the type that cradles the front tires. If the towing apparatus cannot be attached to the front tires or directly to the chassis frame rails, then the suspension sub-frame may be used for attachment.

⚠ WARNING

Attaching towing equipment to improper locations and failure to utilize OEM/Coach Builder recommended towing methods could result in one or more of the following:

- **Loss of vehicle control.**
- **Possible disconnection from tow vehicle.**
- **Damage to the suspension and/or vehicle.**

Do Not attach tow apparatus (hooks, chains, straps, etc.) to suspension upper and lower control arms, front cross-member, brake components, tie rods, relay rod, or steering knuckle assemblies (**Figure 3**).

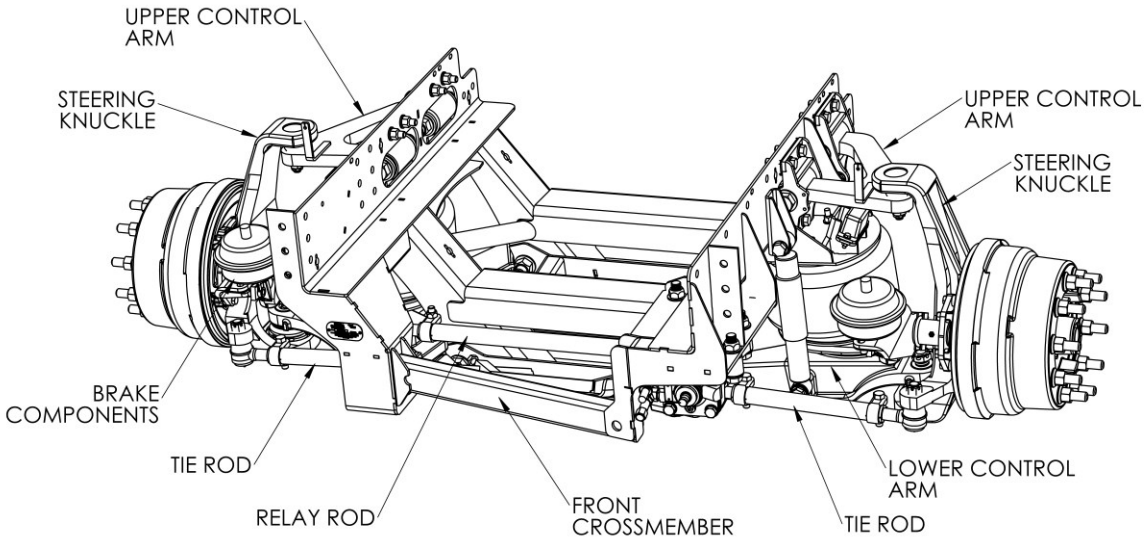


Figure 3 – <u>Improper</u> Tow Equipment Attachment Locations

Maintenance Schedule

GENERAL MAINTENANCE	SERVICE TO BE PERFORMED	MILEAGE IN THOUSANDS							
		12	24	36	48	60	72	84	96
Steering Knuckle Ball Joints	Check axial endplay				X				X[2]
	Inspect for ruptured seals	X	X	X	X	X	X	X	X[2]
	Check nut torque	X							
	Check that cotter pin is installed	X	X	X	X	X	X	X	X[2]
Control Arm Bushings	Check bolt torque				X				X[2]
	Inspect for contact between control arm and mount	X	X	X	X	X	X	X	X[2]
	Inspect for bushing wear	X	X	X	X	X	X	X	X[2]
Relay Rod and Tie Rod Ends	Inspect ball socket endplay	X	X	X	X	X	X	X	X[2]
	Check for looseness of taper connection	X	X	X	X	X	X	X	X[2]
	Check nut torque	X							
	Check that cotter pin is installed	X	X	X	X	X	X	X	X[2]
Brake System	Inspect slack adjuster for correct stroke	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution	X							
Air Springs	Inspect for proper clearance (1" minimum all around)	X							
	Check upper mount nut and lower mount bolt torque	X							
	Inspect for signs of chafing or wear	X	X	X	X	X	X	X	X[2]
	Inspect for air leaks using soapy water solution	X							
Shock Absorbers	Check upper mounting bolt/nut torque	X							
	Check lower mounting bolt torque	X							
	Inspect shocks for signs of fluid leak, broken eye ends, loose fasteners, and worn bushings	X	X	X	X	X	X	X	X[2]
Steering Gearbox / Pitman Arm	Check pitman arm retention nut torque	X							
	Check mounting bolt/nut torque	X							
	Inspect for signs of fluid leak or loose fasteners	X	X	X	X	X	X	X	X[2]
Wheels	Check hub bearing endplay				X				X[2]
	Check wheel nut torque[1]	X	X	X	X	X	X	X	X[2]
Front Alignment	Inspect toe-in[3]		X		X		X		X[2]
	Inspect caster and camber[3]		X		X		X		X[2]
Air Fittings and Air Lines	Inspect for air leaks using soapy water solution	X							
	Inspect for signs of chafing, cracking, or wear	X	X	X	X	X	X	X	X[2]

1. Wheel Nuts must be re-tightened to proper torque specifications as per the vehicle or chassis manufacturer's Owner Guide

2. Continue to perform specified maintenance every 12,000 miles or at previous interval

3. Final stage manufacturer should complete toe-in inspection and adjustment after completion of vehicle

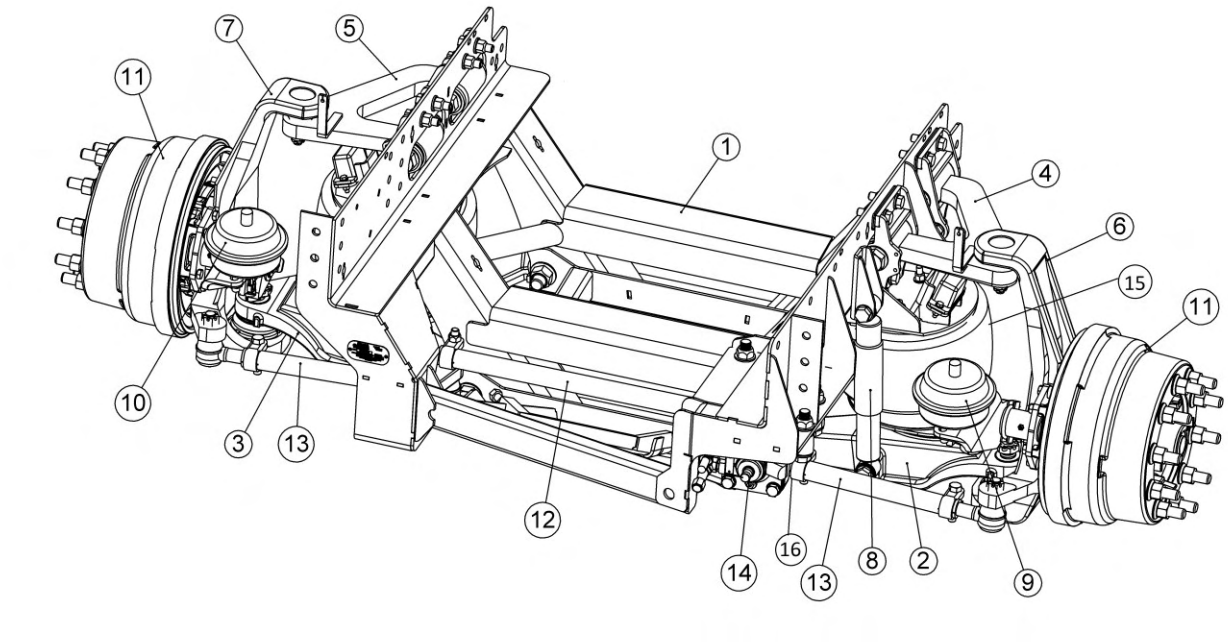
Maintenance Record

Name of Owner:			Address of Owner:
Date of Purchase:	Name and Address of Dealer:		
Model of Vehicle:	Vehicle Identification Number:		
Suspension Model Number: **IFS1000-WF**	Suspension Serial Number:		
Inspection and Maintenance Item	Date	Mileage	Service Performed

Unit Assembly

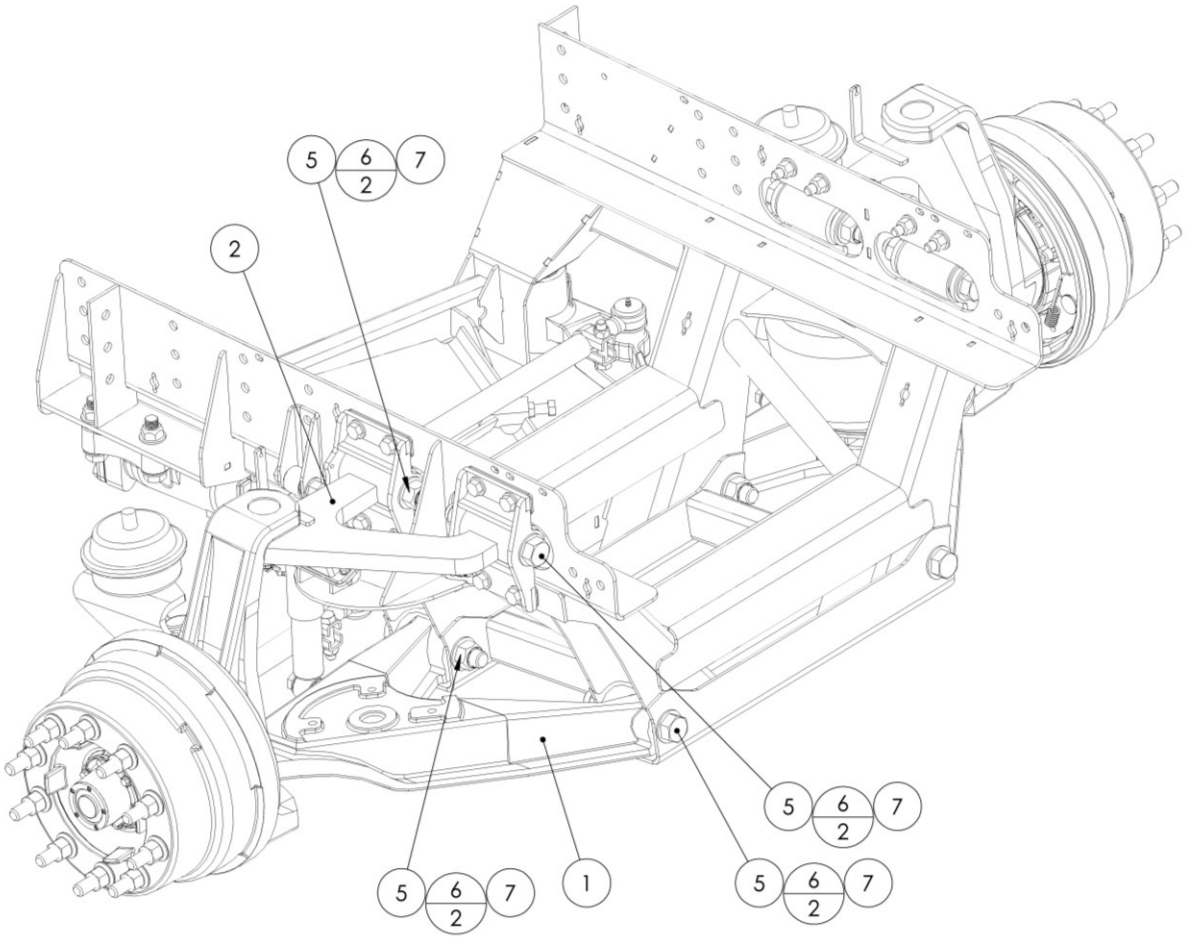
ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	711792-01	Cradle Assembly	9	707819-01	Brake Assembly-LH
2	8757	Lower Control Arm Assembly-LH	10	705951-01	Brake Assembly-RH
3	8756	Lower Control Arm Assembly-RH	11[1]	711878-01	Hub and Drum Assembly
				712211-01	Conmet Hub and Drum
4	711772-01	Upper Control Arm Assembly-LH	12	711775-3284	Relay Rod Assembly
5	711772-02	Upper Control Arm Assembly-RH	13	711775-2084	Tie Rod Assembly
6	8745	Knuckle Assembly-LH	14[1]	712070-02	Steering Gear Assembly
				712070-03	Steering Gear Assy. RR
7	8744	Knuckle Assembly-RH	15	7593	Air Spring Assembly
8	700178-14	Shock Absorber	16	711868-01	Pitman Arm

1. Please call customer service with serial number to determine which gear box and hub assembly you have.



Control Arm Assemblies

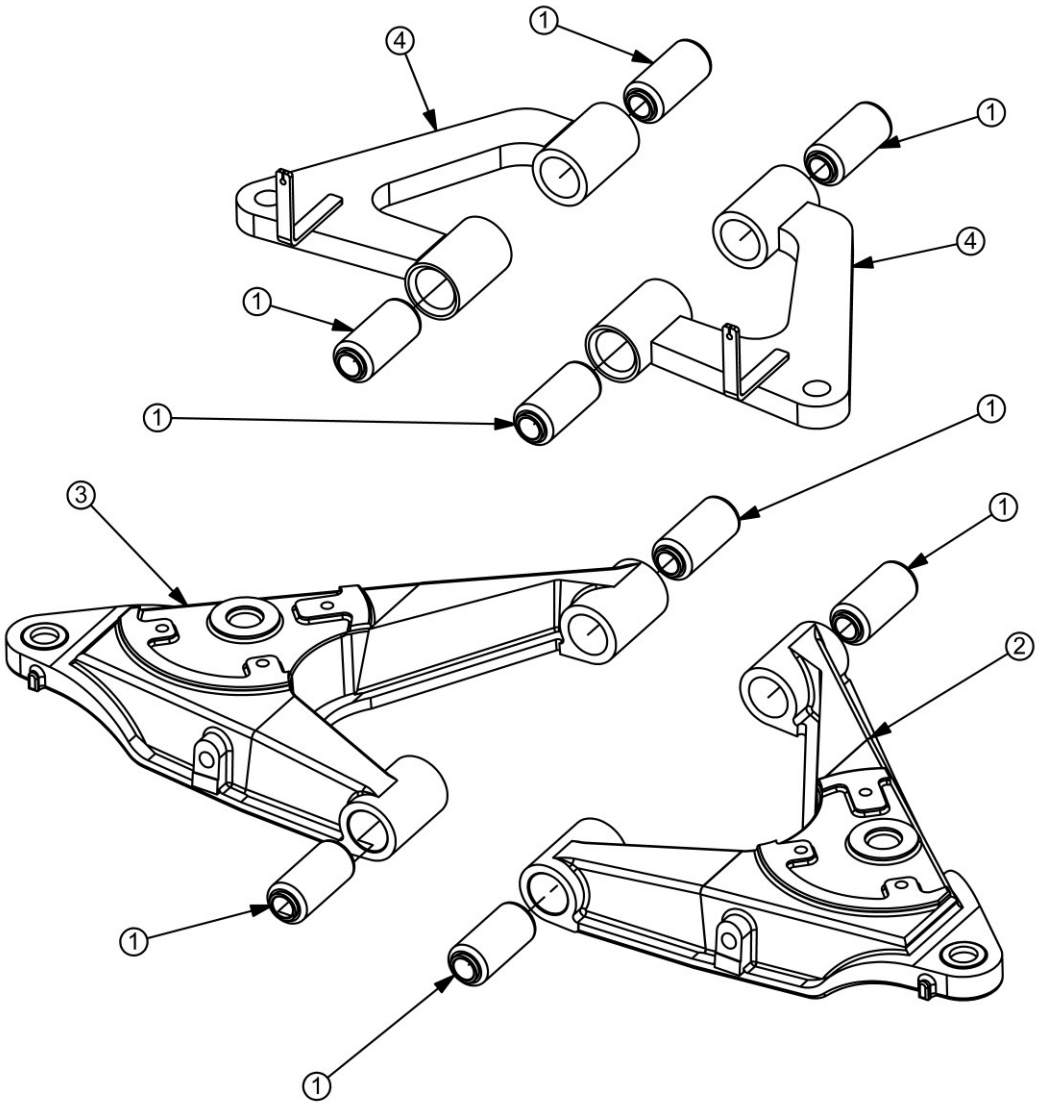
ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	8757	ASY, LOWER A-ARM, LH	5	165	HHB 1.125-12 X 7.5 GR 8 ZY
2	8756	ASY, LOWER A-ARM, RH	6	168	HFW 1-1/8 ZP
3	711772-01	ASY-UCA, LH	7	166	LN 1-1/8-12 XGR C ZY
4	711772-02	ASY-UCA, RH			



Upper Control Arm Mounts

Control Arm Components

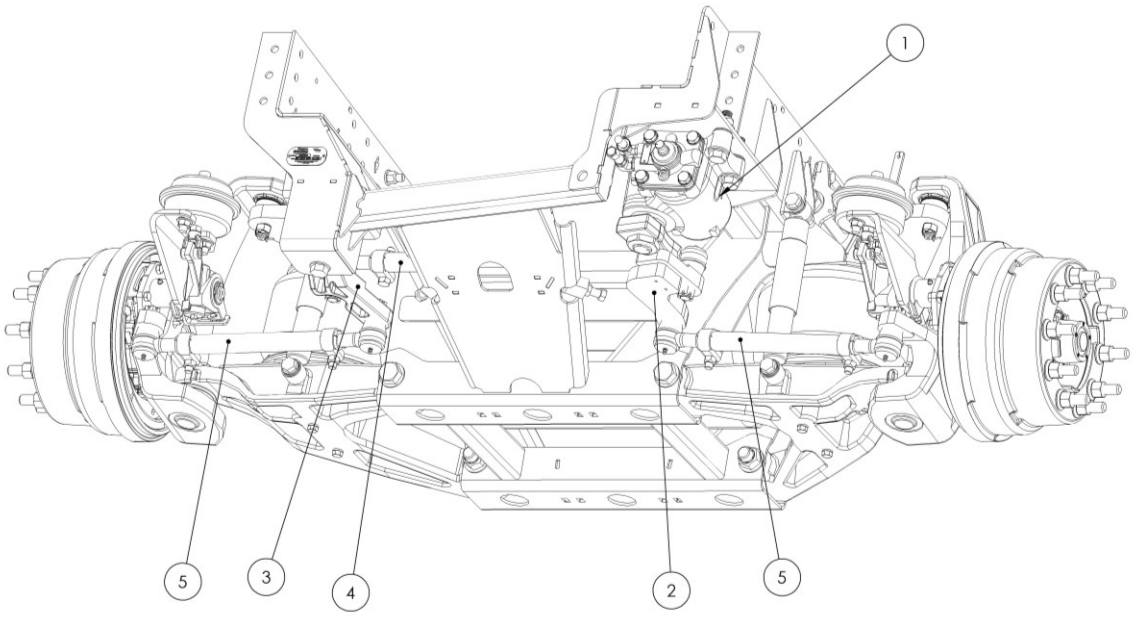
ITEM	PART NO	DESCRIPTION
1	711771-01	ASY-UCA MACHINE-LH
2	711771-02	ASY-UCA MACHINE-RH
3	8737	Machined LCA Casting - LH
4	8736	Machined LCA Casting - RH
5	8382	LCA Bushing



Steering Components

ITEM	PART NO	DESCRIPTION
1[1]	712070-02	STEERING GEAR ASY, ZF 8016 FR
	712070-03	STEERING GEAR ASY, ZF 8016 RR
2	711868-01	PITMAN ARM-ZF SPLINE
3	8089	IDLER ARM (MACHINED)
4	711775-3284	RELAY ROD ASY
5	711775-2084	TIE ROD ASY

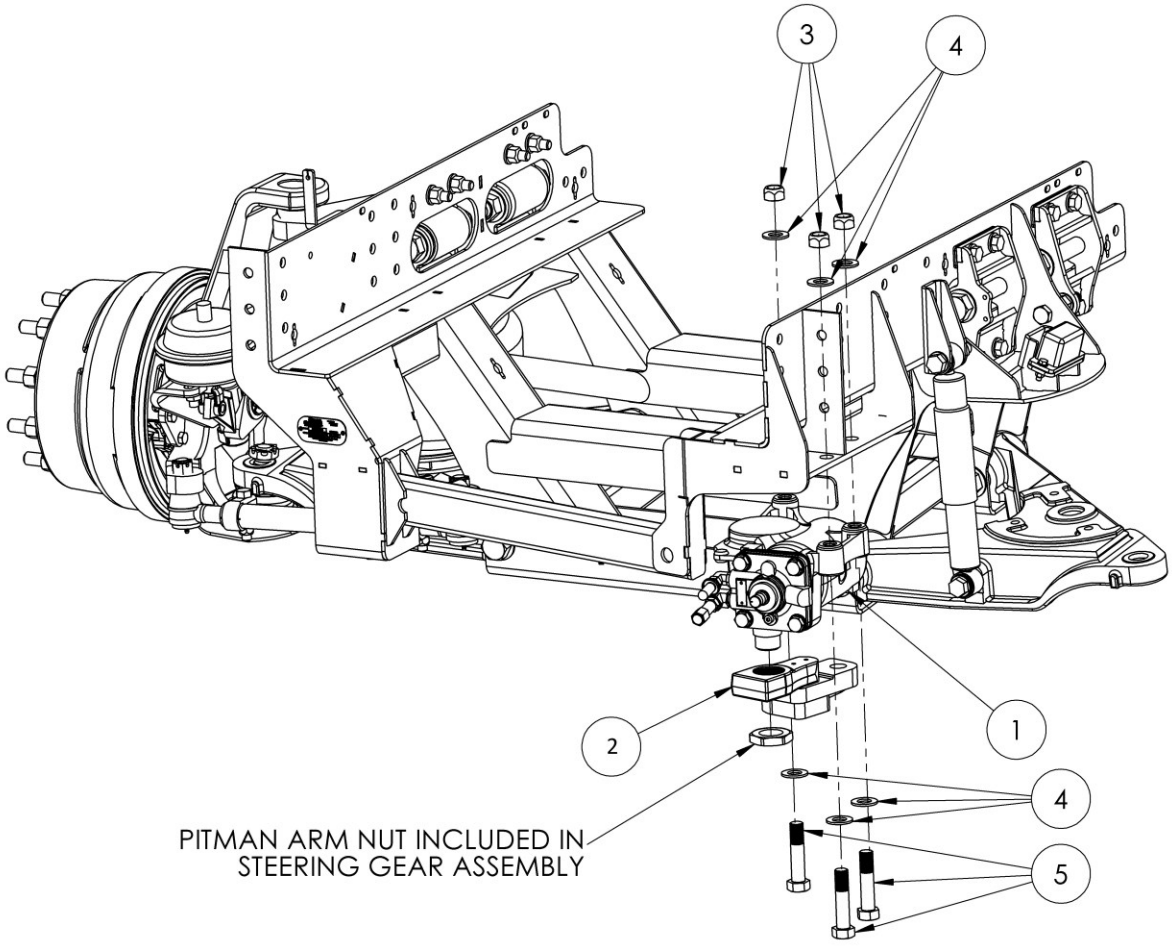
1. Please call customer service with serial number to determine which gear box you have.



Steering Gear Components

ITEM	PART NO	DESCRIPTION
1[1]	712070-02	STEERING GEAR ASY, ZF 8016 FR
	712070-03	STEERING GEAR ASY, ZF 8016 RR
2	711868-01	PITMAN ARM, ZF SPLINE
3	100122-P1	7/8-9 UNC STOVER LOCK NUT GRADE C
4	102354-P1	7/8 FLAT WASHER .938 X 1.75 X .141 ZINC PLATED
5	702637-02	7/8-9 X 4 IN HEX HEAD BOLT GRADE 8

1. Please call customer service with serial number to determine which gear box you have.

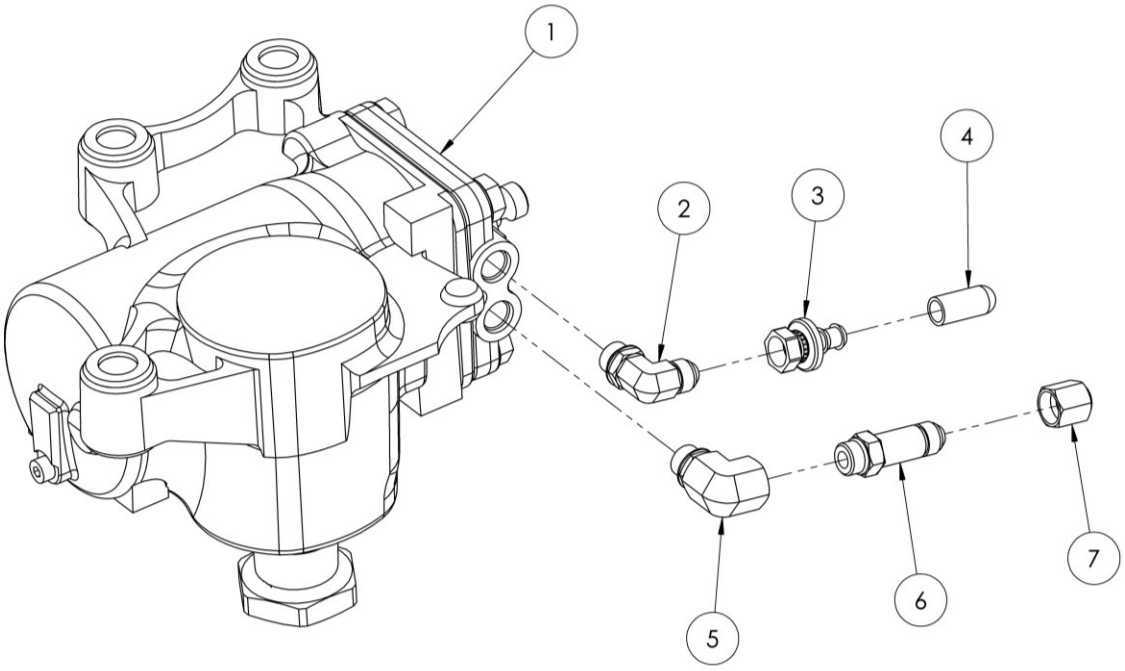


Steering Gear Assembly

ITEM	PART NO	DESCRIPTION
1[1]	704730-01	ASY GEARBOX ZF 8016 FR
	704730-02	ASY GEARBOX ZF 8016 RR
2	710376-01	90DEG ELBOW O8 ORB-M X 08 JIC-M
3	712071-01	1/2 BARB X 08 37DEG JIC-F FITTING
4	712154-01	1/2 IN RUBBER CAP**
5	710215-01	90DEG ELBOW O8 ORB-M X 08
6	710216-01	EXTENSION 08 ORM-M X 08
7	710345-01	CAP, STEEL #8**

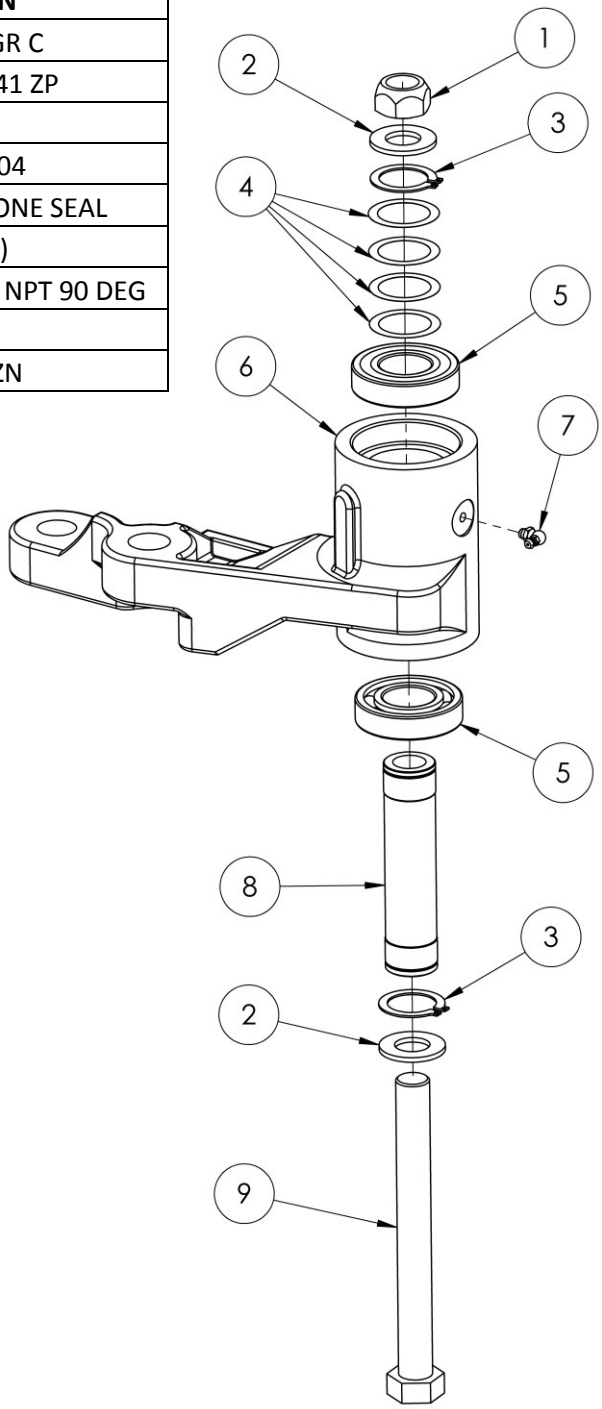
** FOR SHIPPING PURPOSES ONLY

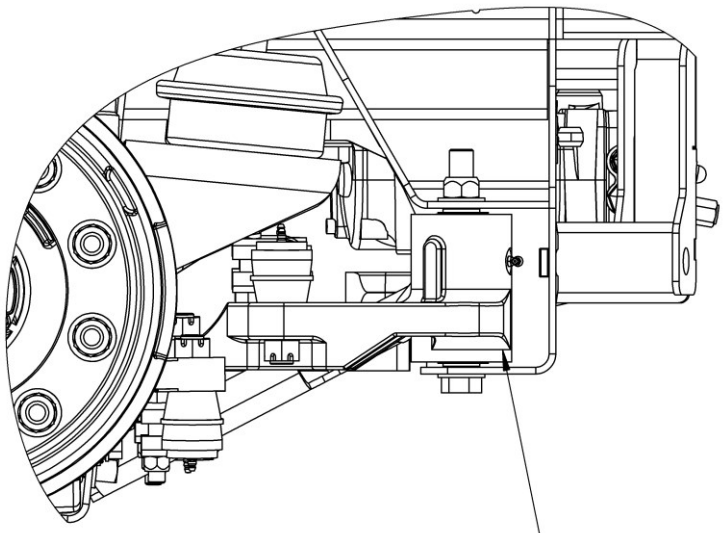
1. Please call customer service with serial number to determine which gear box you have.



Idler Arm Components

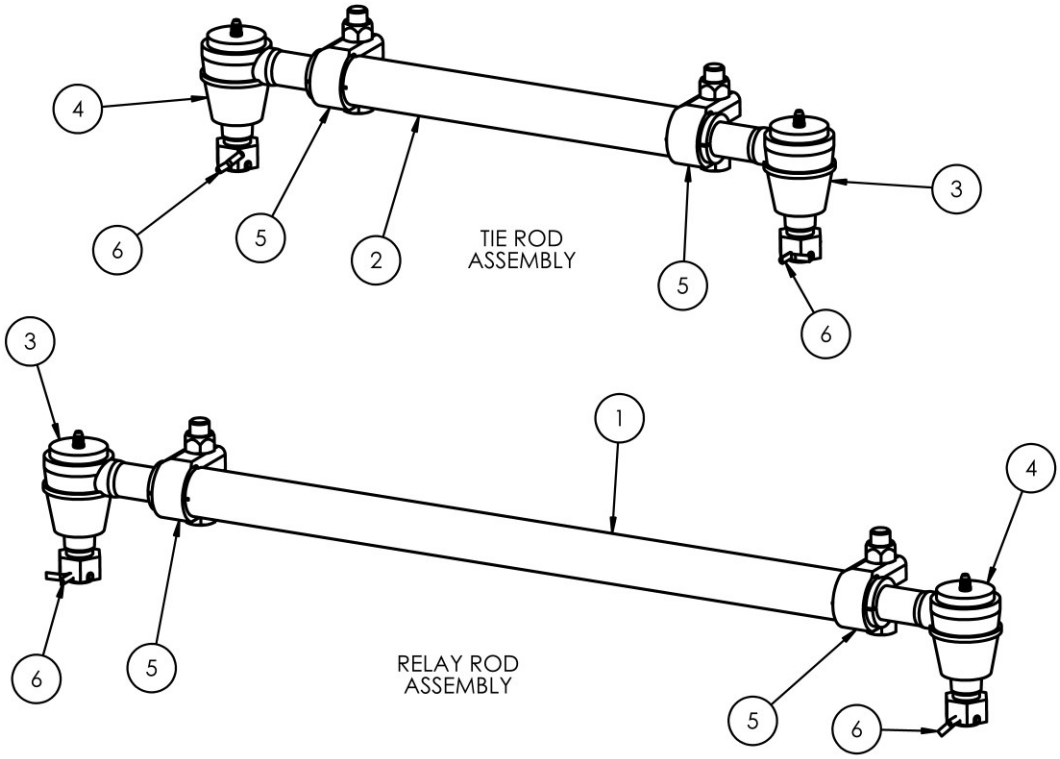
ITEM	PART NO	DESCRIPTION
1	100122-P1	LN 7/8-9 UNC STOVER GR C
2	102354-P1	FW 7/8 .938 X 1.75 X .141 ZP
3	7331	SNAP RING
4	8611	SHIM 1-3/8 X 1-7/8 X .004
5	7332	BEARING SINGLE ROW ONE SEAL
6	8089	IDLER ARM (MACHINED)
7	89411019	GREASE FITTING 1/8-27 NPT 90 DEG
8	7271	SLEEVE
9	292	HHB 7/8-9 X 8.50 GR 8 ZN




IDLER ARM INSTALLED IN CRADLE

Tie Rod Assemblies

ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	711774-2684	RELAY ROD ASY	4	103712	BALL JOINT-RH
2	711774-1484	TIE ROD TUBE	5	6632	TUBE CLAMP
3	103736	BALL JOINT-LH	6	101445-P1	COTTER PIN

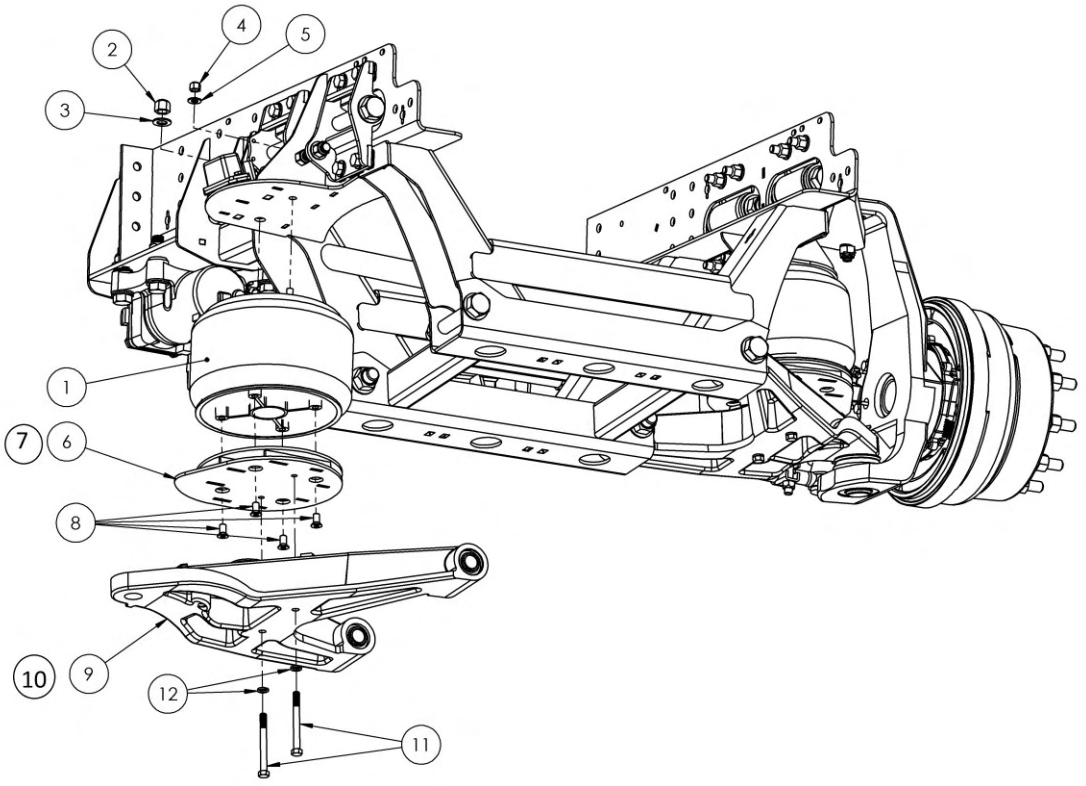


Air Spring Components

ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1[1]	7593	AIR SPRING	7[1]	712210-02	AIR SPRING RELO BRACKET-RH
	712283-01	AIR SPRING		712335-02	AIR SPRING RELO BRACKET-RH
2	178	LFN 3/4-16 GR G	8	709640-02	SFCS 1/2-13 X 1.0
3	20852-01	WSHR, FLAT 3/4 X 148, .120	9	8757	ASY, LOWER A-ARM, LH
4	308	LFN 1/2-13 GR G ZINC	10	8756	ASY, LOWER A-ARM, RH
5	1001601	WSHR, FLAT 1/2 X 1.06, .137 JIT	11	8274318	HHB 1/2-20 X 5 GR 8 ZN
6[1]	712210-01	AIR SPRING RELO BRACKET-LH	12	8120384	SLW 1/2 .523 X .873 X .135 ZN
	712335-01	AIR SPRING RELO BRACKET-LH			

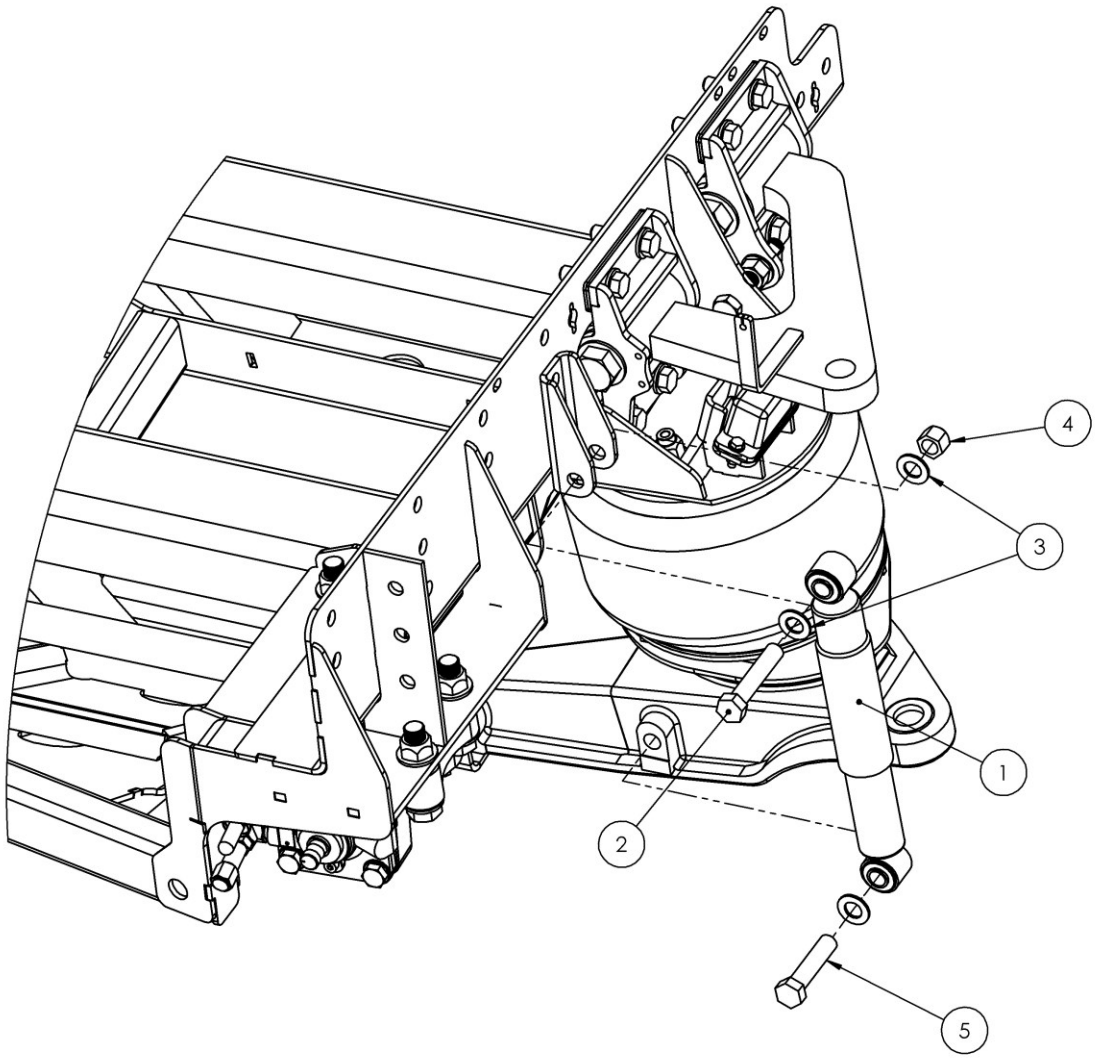
Left hand components shown exploded. Items 7 and 10 are Right Hand components.

1. Please call customer service with serial number to determine which air spring and brackets you have.



Shock Components

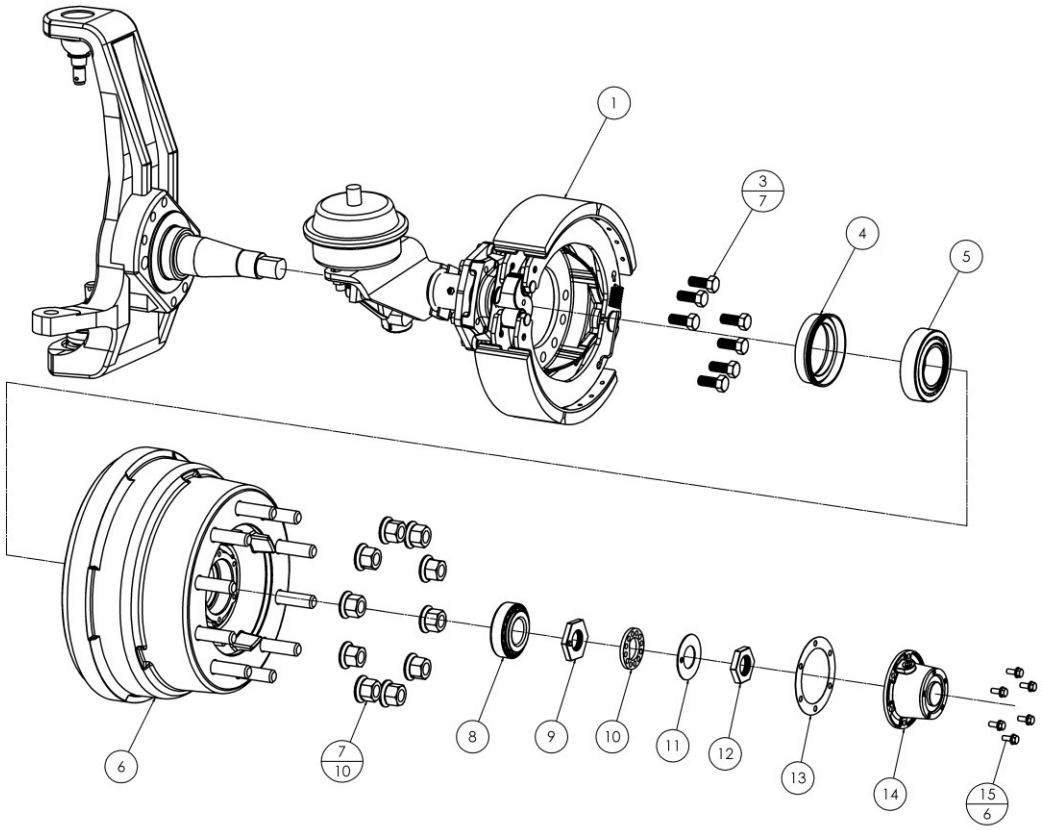
ITEM NO	PART NO	DESCRIPTION
1	700178-14	SHOCK ABSORBER
2	8223833	HHB 3/4-16 X 4 GR 8 ZY
3	20852-01	WSHR, FLAT 3/4 X 148, .120
4	178	LFN 3/4-16 GR G
5	100678-P1	HHB 3/4-10 X 3-1/2 GR 8 ZY



Wheel End Components

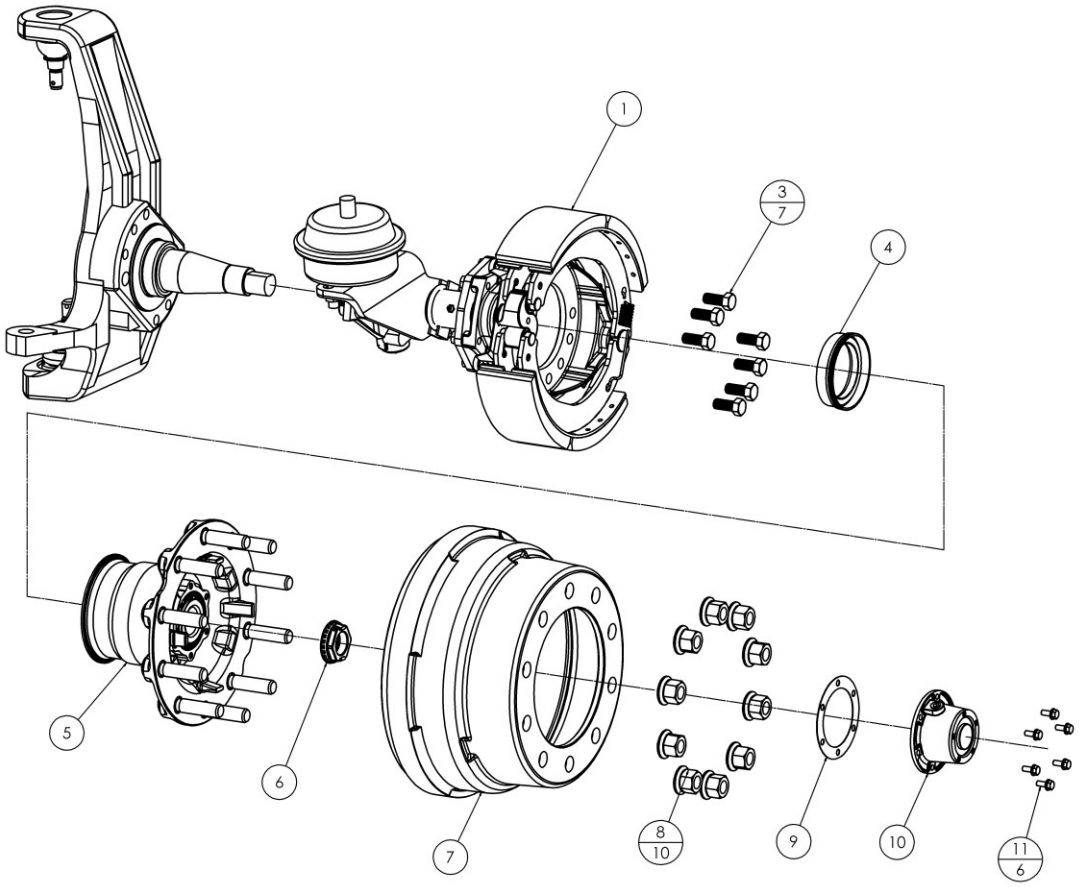
ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	712153-01	BRAKE ASY, 15X4, -16 CHAMBER-LH	9	6967	INNER NUT (IFS)
2	712153-02	BRAKE ASY, 15X4, -16 CHAMBER-RH	10	6968	SPINDLE LOCKWASHER (IFS)
3	287	HHB 5/8-18 X 1-1/2 GR 8 ZY	11	6969	WASHER SPINDLE (IFS)
4	7977	OIL SEAL	12	6970	SPINDLE OUTER NUT (IFS)
5	1784	BEARING-TAPER 2-5/8	13	700024-01	HUB CAP GASKET
6	711878-01	HUB/DRUM ASY	14	700017-01	HUB CAP
7	705310-01	FN M22 X 1.5 X 31 2PC LUG NUT	15	266	FHB 5/16-18 X 3/4 GR 5 ZC W/LS
8	6972	BEARING-TAPER 1-3/4			

Left hand components shown exploded. Items 2 and 4 are Right Hand components.



Wheel End Components

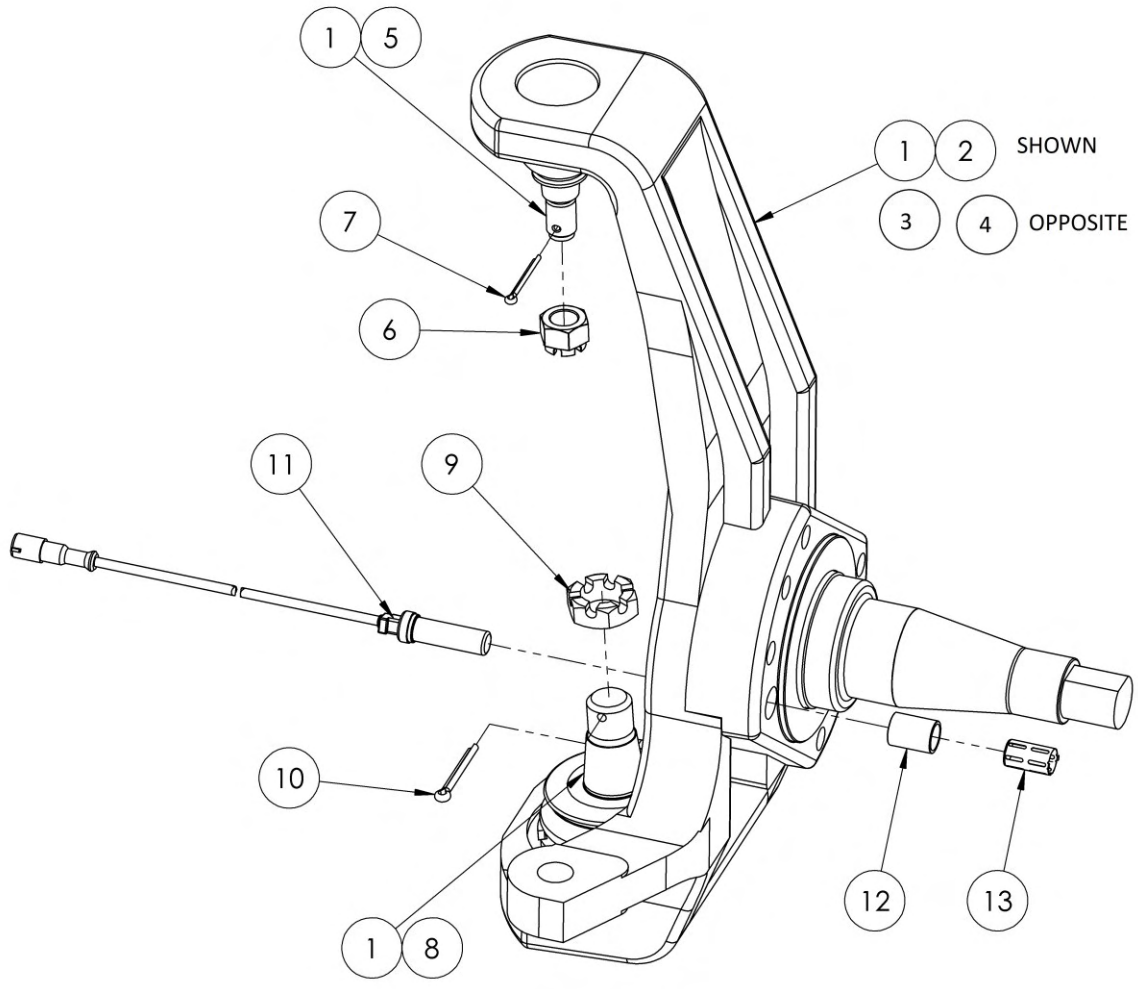
ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	712153-01	BRAKE ASY, 15X4, -16 CHAMBER-LH	7	712216-01	BRAKE DRUM, 15X4
2	712153-02	BRAKE ASY, 15X4, -16 CHAMBER-RH	8	705310-01	FN M22 X 1.5 X 31 2PC LUG NUT
3	287	HHB 5/8-18 X 1-1/2 GR 8 ZY	9	700024-01	HUB CAP GASKET
4	7977	OIL SEAL (included in hub asy)	10	700017-01	HUB CAP
5	712211-01	PRESET HUB ASY	11	266	FHB 5/16-18 X 3/4 GR 5 ZC W/LS
6	712284-01	SPINDLE NUT-LOCKING			



Steering Knuckle Components

ITEM	PART NO	DESCRIPTION	ITEM	PART NO	DESCRIPTION
1	8745	ASY STEER KNUCKLE 12K (DUC) LH	8	705383-01	LOWER BALL JOINT
2	8741	MACHINED KN CASTING-LH	9	705383-02	SN M30X 1.5
3	8744	ASY STEER KNUCKLE 12K (DUC) RH	10	705383-03	COTTER PIN 1/4 X 1.95 ZN
4	8740	MACHINED KN CASTING-RH	11	7328	ABS SENSOR (STRAIGHT WITH LEAD)
5	705382-01	UPPER BALL JOINT	12	705011-27	SLEEVE ABS MOUNTING
6	705382-02	SN M22 X 1.5	13	6946	ABS SENSOR SPRING RETAINER
7	705382-03	COTTER PIN 5/32 X 1.40 ZN			

Left hand components shown exploded. Items 3 and 4 are right hand components.
Item 1 is an assembly containing items 2, 5, and 8.
Item 3 (not shown) is an assembly containing items 4, 5, and 8.



Lubricant Specifications and Intervals

COMPONENT	SERVICE INTERVAL	CHANGE INTERVAL	LUBRICANT SPECIFICATION
Rod Ends of Tie Rods & Idler Arm	Whichever comes first: Every oil change or every 6 months	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Auto Slack Adudjuster	Whichever comes first: Every oil change or every 6 months	N/A	Multi-Purpose Chassis Grease Premium Multi-Purpose Chassis Grease NLGI Grade 2
Wheel End Hub oil	Every 1000 miles[3]	Whichever comes first: Seals replaced, brakes relined, 100,000 miles (160,000 km), or once a year	Gear Oil SAE 80W/90 or equivalent

1. Moly-disulfide type grease is not recommended since it may lower friction capabilities in the adjusting clutch parts of the automatic slack adjuster.
2. Use caution when using an automatic grease gun or seals could possibly be blown out and damaged.
3. Only check level at ride height and only after coach has not move for 15 min or more. Failure to wait will result in false readings.

General Lubrication

Proper lubrication practices are important in maximizing the service life of your ***ReycoGranning***® Independent Front Suspension. See figure 4.

⚠ CAUTION

Do not mix lubricants of different grades. Do not mix mineral and synthetic lubricants. Different brands of the same grade and type may be mixed.

⚠ CAUTION

Never mix oil bath and grease packed wheel ends.

Rod Ends - Tie Rod and
Relay Rod Ends on Tie Rods

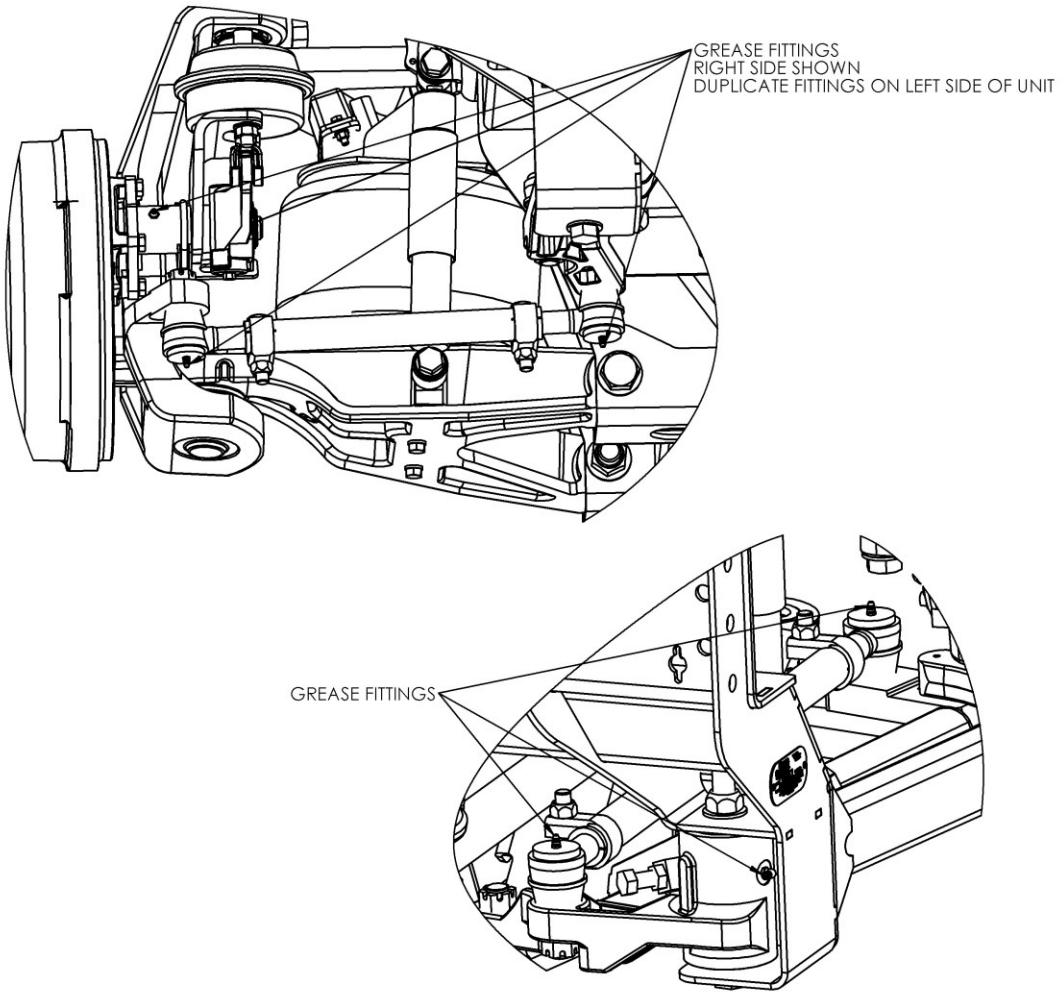


Figure 4 – Locations of Lubrication Fittings

Wheel Bearings

1. Review lubricant specification and interval requirements before servicing.
2. Check oil level through hub cap window. If level is below the "add" level line then remove the pipe plug and fill with recommended oil until "full" level is achieved. (Figure 5) Add oil slowly since the heavy weight oil will settle slowly in the hub. Check only after coach has been at rest for at least 15 minutes. If coach has been moved oil may be distributed around cavity and in bearings resulting in a false low measurement.
3. Check the hub cap for external oil marks. The vent plug will normally weep a small amount of oil. Oil marks in other locations should be addressed by replacing the hub cap seal, window gasket, or tightening the pipe fill plug.

   NOTE: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used, as they will impair the transparency of the window

⚠ CAUTION

Do not remove or twist the red plug at the center of the hub cap. This will damage the hub cap, and cause oil to leak. Add oil only thru the pipe plug or warranty will be void.

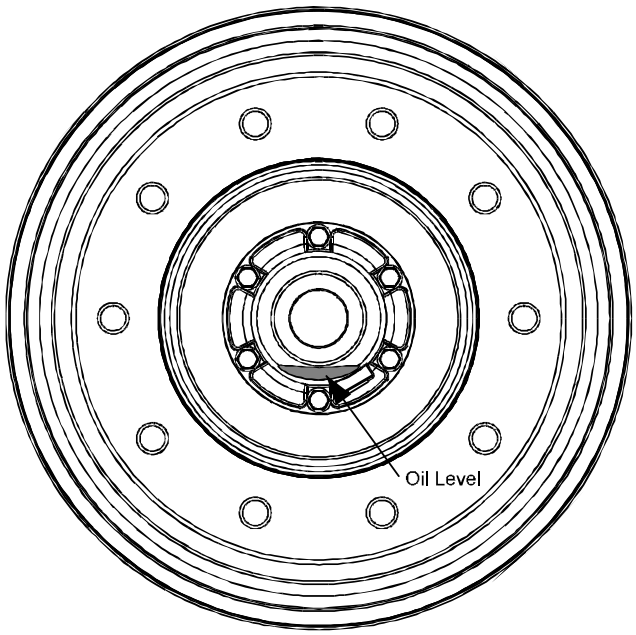


Figure 5 – Wheel Bearing Oil Level

Troubleshooting

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Tires wear out quickly or have uneven tire tread wear **Note:** *Wear pattern will indicate possible cause(s). Consult tire manufacturer for guidance.*	Tires have incorrect pressure	Put specified air pressure in tires.
	Tires out of balance	Balance or replace tires
	Incorrect toe-in setting	Adjust toe-in to specified setting
	Incorrect ride height	Adjust ride height to specified setting
	Incorrect caster/camber adjustment	Adjust caster/camber
	Incorrect steering arm geometry	Adjust tie rod lengths as required
	Improper (mismatched) tires and wheels	Install correct tire and wheel combination
Vehicle is difficult to steer **Note:** *Engine must be running for power steering to be active and able to provide steering assist.*	Improper oversized tires	Install correct tire and wheel combination
	Tires not uniform	Install correct tire and wheel combination.
	Tires have incorrect pressure	Put specified air pressure in tires
	Incorrect steering arm geometry	Adjust tie rod lengths as required
	Steering arm assemblies binding	Check steering arm assembly bearings and lubricate as required
	Steering arm assembly ball joints binding	Inspect ball joints for wear and replace as required
	Tie rod ends binding	Inspect tie rod ends for wear and lubricate as required
	Steering column linkage binding	Align or adjust as required
	Steering miter box binding	Check steering miter box and repair or replace as required
	Steering gear valve binding	Inspect, repair or replace as required
	Steering wheel to column interference	Align or adjust as required
	Power steering pump fluid level low and/or possible leak in system	Add fluid, tighten connections and correct as required
	Power steering pump pressure and flow below specification	Conduct pump flow and relief pressure tests and adjust, repair or replace as required
	Air in power steering system	Add fluid, tighten connections and bleed system
	Contaminated or incorrect fluid	Replace with correctly specified fluid
	Obstruction with steering gear pitman arm or within hydraulic lines	Inspect, remove obstruction(s) and repair or replace as required
	Obstruction within wheelhouse	Inspect, remove obstruction(s) as required
	Excessive internal steering gear leakage	Inspect, repair or replace as required

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle wanders side-to-side…loose steering **Steering wheel has large amplitude, rotational oscillations when hitting large bumps**	Vehicle overloaded or unevenly loaded driver side to passenger side	Check wheel loads and correct as required
	Improper (mismatched) tires and wheels	Install correct tire and wheel combination
	Tires have incorrect pressure	Put correct air pressure in tires based on wheel load
	Incorrect toe-in setting	Adjust toe-in to specified setting
	Incorrect wheel caster setting	Adjust wheel caster to specified setting
	Tie rod end connection loose or ball stud worn	Inspect ball stud connections and wear
	Steering arm assembly mounts loose	Check and tighten to specification
	Steering arm assembly ball joints binding or worn	Inspect ball joints for wear or contamination and replace as required
	Wheel bearings out of adjustment	Check wheel bearing end play and adjust as required
	Loose steering gear mounting	Check mounting and secure as required
	Loose pitman arm	Check pitman arm and tighten as required
	Steering column linkage worn	Check for wear and repair or replace as required
	Steering gear lash adjustment	Check and adjust to specification
	Steering column misaligned	Realign steering column as required
	Loose Wheel Nuts	Check and tighten to specification
Vehicle pulls to one side without the brakes applied.	Vehicle overloaded or unevenly loaded driver side to passenger side	Check wheel loads and correct as required
	Improper (mismatched) tires and wheels	Install correct tire and wheel combination
	Tires have incorrect pressure	Put correct air pressure in tires based on wheel load
	Unequal ride height side to side	Inspect ride height and adjust to specified setting
	Improper brake adjustment	Inspect and adjust slack adjusters as required
	Incorrect rear axle alignment	Align rear axle to specified thrust angle
	Incorrect caster and/or camber setting	Check and adjust as required
	Wheel bearings out of adjustment	Check wheel bearing end play and adjust as required
	Loose steering gear mounting	Check mounting and secure as required
	Tie rod end connection loose or ball stud worn	Inspect ball stud connections and wear
	Bent spindle or steering arm	Inspect and replace as required
	Frame or underbody out of alignment	Inspect and correct as required
	Incorrect toe-in setting	Adjust toe-in to specified setting
	Mis-aligned belts in radial tires	Check and replace as required
	Steering gear valve binding	Inspect, repair or replace as required
	Steering gear not centered	Inspect and adjust as required
	Excessive internal steering gear leakage	Inspect, repair or replace as required
	Excessive water puddling on road	Avoid water puddles on road
	Boot contact w/ bottom of steering column	Inspect, Repair, Adjust as required

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle pulls to one side with the brakes applied	Grease, oil or dirt on brake pads	Replace brake shoes as required
	Brake shoes are glazed	Deglaze brake shoes by burnishing or replace as required
	Brake shoes are not a balanced set, different friction codes or pad brand	Replace brake shoes as required
	Loose or broken brakeshoes	Replace brake shoes as required
	Brake drum warped	Re-machine or replace brake rotor as required
	Defective brake drum	Inspect for defects and replace as required
	Brake air chamber clevis pin or camshaft binding	Check and lubricate as required
	High spots on one set brake shoes with respect to opposite side	Match machine shoes to drums
	Uneven brake adjustment side to side	Adjust brake as required
	Different brake air chamber size side to side	Replace with same size brake air chambers
	Brake chambers air pressure uneven side to side	Check side-to-side air pressure and correct as required
	Rear axle brakes misadjusted or contaminated	Check, adjust, or replace as required
	ABS system malfunction	Check ABS system for proper function
	Air leak or obstruction in air brake lines	Check fittings with soapy water solution and remove obstructions
	Brake air chamber air leak or diaphragm damaged	Check chamber for air leak and damaged diaphragm
	Excessive water puddling on road	Avoid water puddles on road
Vehicle rolls side to side excessively	Front and/or rear shock absorbers worn	Replace shock absorbers as required
	Shock mounting loose	Check and tighten as required
	Shock eye bushings worn	Check and replace as required
	Sway bar bushings worn	Check sway bar bushings and replace as required
	Sway bar mounting brackets loose	Check sway bar mounting brackets and tighten as required
	Control arm pivot bushings worn	Inspect and replace as required
	Internal leak in height control valve	Check height control valve and replace as required
Front tires lock up during hard braking or ABS malfunction light remains lit	ABS sensor malfunction	Inspect ABS sensor installation and replace sensor as required
	ABS CPU or system malfunction	Check and repair or replace as required
	ABS sensor electrical connection faulty	Check ABS sensor connection and lead wire
	Tone ring on hub damaged	Check for damage and replace as required

SYMPTOMS	POSSIBLE CAUSES	REMEDIES
Vehicle ride is too harsh and/or suspension contacts stops excessively	Front shock absorbers worn	Replace shock absorbers as required
	Incorrect ride height	Adjust ride height to specified setting
	Vehicle overloaded	Check wheel loads and correct as required
	Air spring supply lines leaking or obstructed	Check air line connections and remove obstructions
	Vehicle system air pressure below specification	Check air pressure and correct as required
	Rebound bumper worn or missing	Check and replace as required
	Jounce bumper in air spring worn or broken	Check and replace air spring as required
Vehicle ride is too soft	Vehicle air pressure insufficient	Install check valves to prevent air back flow
	Insufficient load	Add load to increase spring rate
	Front shock absorbers worn	Replace shock absorbers as required
	Incorrect ride height	Adjust ride height to specified setting
Vehicle has unequal turning radius right to left	Incorrect steering arm geometry	Adjust tie rod lengths as required
	Steering gear not centered	Inspect and adjust Pitman arm as required
	Steering gear poppet valves set incorrectly	Check wheel turn angles and adjust as required
	Tie rod clamps positioned improperly	Check orientation and adjust as required
Suspension does not maintain ride height	Air leak	Check connections with soapy water solution and repair or replace as required
	Internal leak in height control valve	Check height control valve and replace as required
	Height control valve linkage loose	Check and tighten linkage as required
	Air spring chafed or worn	Check air spring and Replace as required
	Insufficient air pressure do to back flow	Install check valves to prevent back flow
Brakes are noisy	Grease, oil or dirt on brake shoes	Replace brake shoes as required
	Brake shoes are glazed	Deglaze brake shoes by burnishing or Replace as required
	Brake shoes are not a balanced set, different friction codes or brand	Replace brake shoes as required
	Loose or broken brake shoes	Replace brake shoes as required
	Brake Drum Warped	Re-machine or Replace as required
	Defective Brake Drum	Inspect for defects and Replace as required

Contact Customer service at 1-800-753-0050

General Inspection

Perform a thorough visual inspection of the suspension to ensure proper assembly and to identify broken parts and loose fasteners each time the vehicle suspension is serviced. Do the following during an inspection.

Wheel Alignment - Follow the guidelines in the Front Wheel Alignment section for wheel alignment inspection intervals. Check wheel alignment if excessive steering effort, vehicle wander, or abnormal tire wear is evident.

Fasteners - Check that all the fasteners are tightened to the proper tightening torque. Use a calibrated torque wrench to check torque.

Wear and Damage - Inspect components of the suspension for wear and damage. Look for bent or broken components. Replace all worn or damaged components.

Operation - Check that all components move freely through the complete wheel turning arc.

⚠ CAUTION

Reyco Granning LLC recommends replacing any damaged or out-of-specification components. Reconditioning or field repairs of front suspension components is prohibited. Some cast components are heat-treated. These components as well as other non-heat treated castings cannot be bent, welded, heated, or repaired in any way without reducing the strength or life of the component thus voiding the warranty. Only genuine *ReycoGranning*® replacement components are allowed.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle to drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension sub-frame, or chassis frame for inspections that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before inspections.

Inspecting the Control Arm Bushings for Wear

NOTE

It is recommended that the bushings in all of the control arms be replaced at the same time if one is found worn.

1. Check clearance between each control arm and sub-frame bushing mount. Look for contact pattern as evidence of bushing wear. Replace worn bushings in both control arm housings as needed.
2. Check for bushing bulging between the control arm and sub-frame mount or presence of small rubber particles near sub-frame bushing mount.

3. Check that the control arm mounting bolts are tight. Recommended torque is **465-485 ft-lb** for lower control arms and **950-1050 ft-lb** for upper control arms (See Torque Table). A loose joint will result in wear between the bushing inner sleeve and sub-frame mount.

Inspecting the Tie Rod Ends

⚠ WARNING

Do not use a wrench or other object to apply leverage when inspecting tie rod end sockets. Applying leverage can yield incorrect results and damage components. Component damage can lead to the loss of steering control.

1. With the engine on, lightly rock the steering wheel and have an assistant observe any looseness in the two mating tapers or any movement of the stud nut at both ends of the tie rod. If looseness is found in either place go to step 2, otherwise skip to step 3.
2. Remove the tie rod end ball stud from the taper mount and visually inspect both. If either of the mating tapers shows distortion or wear, then both components must be replaced. Torque Tie Rod Castle Nuts to **90-100 ft-lb** (See Torque Table).
3. With the engine off and the wheels steered straight ahead, grab the tie rod near its end and try to move the socket in a direction parallel to the ball stud axis (**Figure 6**). Be sure to only apply hand pressure to the tie rod.
4. Measure the axial movement with a scale. If the movement is greater than 1/8 inch (3mm) replace the tie rod end immediately. If the socket moves but the movement is less than 1/8 inch (3mm) then the tie rod end should be replaced before 1/8" (3mm) movement occurs.
5. Check dust boot for damage. Replace as needed.
6. Check tie rod clamp orientation

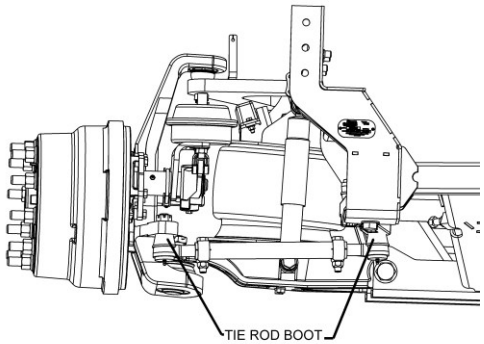


Figure 6 - Tie Rod

Inspecting the Brake System

The suspension system is equipped with Haldex brand automatic slack adjusters for steer axles. Refer to Haldex technical service guideline #485-89007 for inspection and adjustment procedure.

Brake System

The suspension system is equipped with Dana 15x4 S-cam air brakes. Refer to Dana maintenance manual #SHA 589-1 5M service procedures.

Inspecting the ABS Sensor and Tone Ring

1. The wheels and may need to be removed to ease inspection of tone ring and sensor.
2. Disconnect the ABS sensor lead from the chassis connector.
3. The ABS sensor test will require a voltmeter that can measure AC voltage on a 0-10V scale.
4. Connect the voltmeter to the connector pins of the ABS sensor lead.
5. Set the voltmeter scale to millivolts and the voltage source to AC volts.
6. Rotate the wheel hub by hand and record the voltage output from the ABS sensor. A minimum output of 0.8V AC is normal.
7. If the minimum voltage output is not achieved, check lead wire connections and repeat Step 3. Otherwise, if the minimum voltage output is not achieved after repeating Step 3 then go to Step 5.
8. Check physical gap between the sensor and tone ring (**Figure 7**). The maximum allowable gap is .027 inch. If the gap is greater than .027 inch, press on the wire lead end of the sensor and push the sensor into contact with the tone ring. Check that the ABS spring retainer and bushing are not unseated. Re-seat components as needed.
9. Inspect the tone ring on the hub for physical damage and proper installation onto the hub. The tone ring should have a maximum run out of .008 inch relative to the hub/spindle centerline.
10. Repeat Step 3. If voltage output is less than 0.8V AC then replace the ABS sensor.

NOTE: Check voltage output of new sensor.

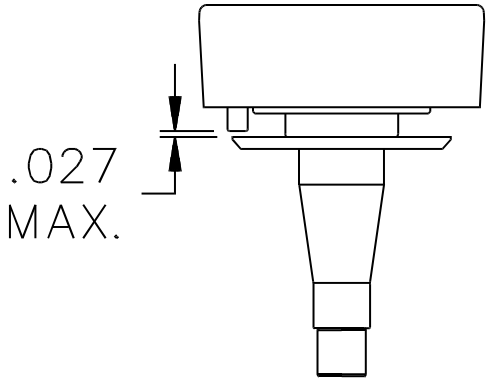


Figure 7 - ABS Sensor and Tone Ring Gap

Inspecting the Shock Absorber

1. Check shock absorbers for oil leakage, bent components, missing or broken components, excessive corrosion, or worn bushings. Replace shock absorbers if any of the above items is present.

Inspecting the Air Spring

Air Spring Inspection

1. Refer to Firestone's Preventative Maintenance Checklist for additional air spring information.
2. Check the outside diameter of the air spring for irregular wear or heat checking.
3. Check airlines to make sure contact does not exist between the airlines and the outside diameter of the air spring. Re-secure airlines to prevent contact as needed. Check for airline and fitting leaks with soapy water solution.
4. Check to see that there is a minimum of 1-inch clearance around the circumference of the air spring while it is energized with air.
5. Check the air spring piston for buildup of foreign material. Remove any foreign material that is present.

Inspecting the Idler Arm

1. Check that steering arm assembly pivots are free of foreign material and bearing seals are in place.
2. Start vehicle engine. Oscillate the steering wheel and observe the motion of the steering arm assemblies (see figure 8). The steering arm assemblies should not exhibit any noticeable conical motion about their pivot axes.
3. If any conical motion is observed check pivot bolt torque which should be **575-625 ft-lb** (See Torque Table). Otherwise, replace the bearing set of the steering arm assembly that exhibits conical motion.

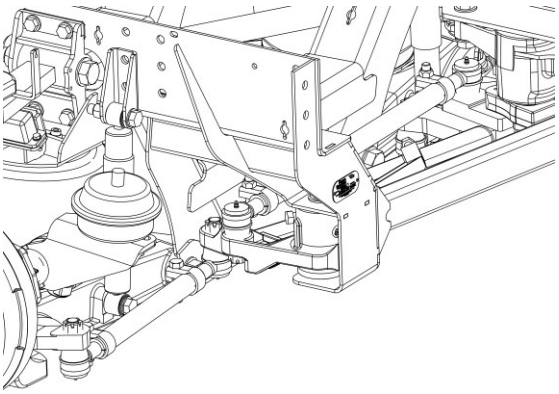


Figure 8 - Steering Arm Assemblies

Endplay Inspection

1. Install a dial indicator with a magnetic base so that the base is fixed to the steering arm assembly. Place the indicator tip on the flat area of the Relay Rod adjacent the castle nut.
2. Using a C-clamp, squeeze the Relay Rod and the steering arm assembly together to seat the ball joint. Do not apply excessive clamp load.
3. Set the dial indicator on "zero".

4. Release the clamp. Place the pry bar between the steering arm assembly and the Relay Rod. **Do not allow the pry bar to contact the ball joint seal.** Firmly pry upward using the steering arm assembly as a fulcrum to lift the Relay Rod. The pry load must not cause the Relay Rod to rotate thus causing the Relay Rod to change orientation.
5. Record the dial indicator reading. A reading greater than .040" will require ball joint replacement.
6. Inspect ball joint seal for damage and replace the ball joint if damaged during measurement process.

Inspecting Wheel Bearing Endplay

1. Remove the tire and wheel.
2. Remove the hub cap.
3. Attach a dial indicator with a magnetic base to the face of the hub.
4. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero (Figure 9).

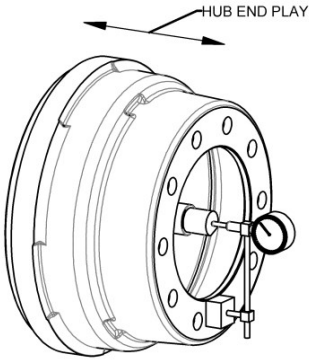


Figure 9 - Wheel End Play Measurement

NOTE
Do not push/pull at the top and the bottom of the hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the endplay.

5. Measure the endplay by simultaneously pushing/pulling on opposite sides of the hub while observing the dial indicator. The endplay is the total travel observed. If the endplay is not within .001-.005", see the section on adjusting the wheel bearing endplay.

Replacing the Ball Joints

Ball joints may be replaced individually, however, it is recommended to replace upper and lower ball joints at the same time. The ball joints cannot be rebuilt or repaired.

Thread-In Mount

The thread-in mount type upper and lower ball joints are installed with a thread adhesive and may require the threads to be warmed to ease removal. If heat is applied to the ball joint threads, the steering knuckle temperature must not exceed 300° F and the heat should be applied at the bottom of the ball joint base only. Applying heat to the ball joint will damage the ball joint by destroying the ball stud seal permanently, degrading the lubricant, and restricting ball stud movement.

It is recommended that the appropriate tools be used to remove the ball stud taper from the control arms and to remove the ball joints from the steering knuckle. A suspension alignment should be performed after ball joint replacement.

NOTE: Be careful to not displace or damage ball joint seals during removal from the control arm taper hole.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. Remove the tires and check that the air springs are deflated.

Upper Ball Joint Removal - Thread-In Mount

1. Remove the cotter pin from the ball stud.

2 Remove the castle nut from the ball stud.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm.

3 Disconnect the upper control arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION: Do not strike the upper control arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4 Inspect the ball joint taper and upper control arm tapered hole. If abnormal wear exists on the ball stud taper or in the tapered hole, replace the upper control arm.

5 Secure steering knuckle in a vise or similar device. Loosen the ball joint and remove it from the

Upper Ball Joint Installation - Thread-In Mount

1. Inspect the threads in the steering knuckle and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint threads and thread the ball joint into the steering knuckle.
3. Tighten the base of the ball joint to **325-375 lbf•ft**. See Torque Table.
4. Follow steps 6-8 for press-in mount type.

Lower Ball Joint Removal

1. Remove the cotter pin from the ball stud.
2. Remove the castle nut from the ball stud.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm.

3. Disconnect the lower control arm. The ball stud may be forced from the tapered hole by use of a suitable tool.

CAUTION: Do not strike the lower control arm directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

4. Inspect the ball joint taper and upper control arm tapered hole. If abnormal wear exists on the ball stud taper or in the tapered hole, replace the lower control arm.
5. Secure steering knuckle in a vise or similar device. Loosen the ball joint and remove it from the steering knuckle.

Lower Ball Joint Installation

1. Inspect the threads in the steering knuckle and remove any burrs or debris.
2. Apply thread adhesive Loctite #242 or equivalent to the ball joint threads and thread the ball joint into the steering knuckle.
3. Tighten the base of the ball joint to **525-575 lbf•ft**. See Torque Table.
4. Connect the ball joint to the lower control arm.
5. Tighten the castle nut to **330-370 lbf•ft**. See Torque Table.
6. Install the cotter pin. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.

Checking and Adjusting the Wheel Bearings

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. If the tire and wheel are not removed make sure all the wheel nuts are tightened to the specified torque of **450-500 lbf•ft**. See Torque Table.
4. If the tire and wheel are removed (recommended for aluminum wheels) secure the brake drum to the hub with the wheel nuts or remove the brake drum.
5. Remove the vent plug from the hub cap.

Adjustment

Note: Some models equipped with conmet preset hubs, contact customer service with serial number for specification.

1. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
2. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
3. Remove the hub cap bolts, hub cap, and gasket. Take care not to damage the gasket for reinstal-lation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents.

4. Attach a dial indicator with a magnetic base to the face of the wheel, hub, or brake drum. The dial indicator may also be attached to the bottom of the brake drum if the wheel is removed.
5. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero. (See Figure 10).

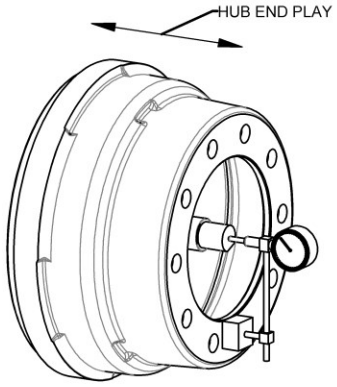


Figure 10 - Wheel End Play Measurement

NOTE: Do not push/pull at the top and the bottom of the tire, drum, or hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the end play.

6. Measure the end play by simultaneously pushing/pulling on each side of the tire, drum, or hub while observing the dial indicator. The end play is the total travel observed. If the end play is not within .001-.004 inch for standard nuts and .001-.005 for preset hub adjust the wheel bearings per steps 4-16. (See Figure 21). Otherwise skip to step 21. For standard nut continue with step 7-15 and 21-23. For preset hub skip to step 16-21.

NOTE: When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

7. Unbend the retainer washer and remove the spindle outer nut, retainer washer, and locking washer. Loosen the inner spindle nut.
8. Seat the bearings by tightening the inner spindle nut to **180 lbf•ft**. while rotating the wheel in both directions.
9. Rotate the hub and drum ten (10) complete revolutions.
10. Loosen the inner spindle nut completely and then tighten the nut to **20 lbf•ft**.
11. Back off the inner spindle nut 1/4 turn.
12. Install spindle locking washer.

NOTE: If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.

CAUTION: Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

13. Install the retainer washer and outer spindle nut. Tighten outer spindle nut to **200-300 lbf•ft**. See Torque Table.
14. Verify that wheel end play is between .001-.004 inch. (See step 6). If not, repeat by altering amount of inner nut back off until end play is achieved.
15. Bend retainer washer over one wrench flat of the outer nut.
16. Use 2 1/8" socket to loosen locking spindle nut.
17. Place 2-4 Drops of oil on spindle threads. Align retainer cage tab ("D" flat) on locking spindle nut with "D" flat on spindle. Rotate socket by hand clockwise until locking spindle nut contacts outer bearing in hub assembly. Do not use powered tool to run bearing down against bearing. If locking spindle nut will not rotate freely on spindle, nut may be cross threaded. Rotate counter clockwise until threads disengage. Repeat locking spindle nut installation.
18. Rotate hub assembly back and forth while tightening locking spindle nut to final torque of 300 ft-lb.
19. Remove socket and verify locking clip tabs have engaged the adjustment slots in retainer cage on locking spindle nut.
20. Measure end play between hub assembly and spindle with dial indicator. Acceptable end play between hub and spindle is .001-.004 inches.
21. Install hub cap gasket and hub cap. Tighten the cap screws to 20-30 lbf•ft. See Torque Table. Replace the hub cap vent plug if removed in Preparation step 5.
22. Fill the hub cavity with the appropriate amount and type of lubricant. (See Section 4 for lubricant specifications).
23. Install vent plug

Adjusting Suspension Ride Height

The height control valve (HCV) and linkage should be checked regularly for proper clearance, operation and adjustment.

NOTE

Improperly adjusted ride height will result in incorrect wheel alignment measurements and may result in abnormal tire wear. Check the ride height prior to front suspension alignment.

The ride height of the front suspension is the distance from the bottom of the chassis frame rail to the center of the wheel

spindle. An alternate measurement may be taken as the height of the air spring (**Figure 11**).

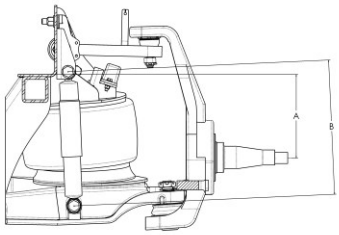


Figure 11 – Measurement at Ride Height

Unit	Ride Height "A"	SHOCK HT "B"
IFS1000WF	9.37"	15.59"

Properly adjusted ride height results in correct suspension travel and alignment. The ride height should not be adjusted to adjust chassis rake angle.

⚠ CAUTION

Adjusting the ride height can cause the front end to raise or lower unexpectedly due to vertical movements at the connection of the vertical link and the horizontal arm of the height control valve.

1. Park the vehicle on a level surface.
2. Exhaust or "dump" and re-inflate the air suspension. Allow the Suspension to settle.
3. Check ride height of rear suspension:

   A: On vehicles with front suspension equipped with (2) height control valves, check and adjust the rear suspension first.

   B: On vehicles with front suspension equipped with a single height control valve, check and adjust the rear suspension after finish adjusting the front.

4. Measure either the wheel center to bottom of frame ("A") or air spring height ("B"). If the dimensions are not within ±1/8" of measurements in **Figure 11** adjust as follows.

   A: Loosen the height control valve linkage stud retaining nuts.

   B: Raise or lower the L-shaped linkage stud as necessary.

   C: Tighten the retaining nuts.

NOTE: It is recommended that the upper and lower studs be positioned parallel to each other. Torque to **8-12 ft-lb**.

5. After adjusting the length, it is recommended to dump and re-inflate the air suspension to obtain the ride height. Allow the suspension to settle.
6. If not already completed, adjust the rear suspension per manufacturer's recommendations.
7. Verify at each axle that the side-to-side ride heights are within .25" of each other.

Adjusting the Maximum Wheel Turn Angle

⚠ CAUTION

Do not adjust maximum wheel turn angle greater than 42.5°. Mis-adjustment of the wheel turn angle can cause damage to steering system components.

The turn angle may require adjustment if the front tires rub against the frame, suspension, body, or the steering gear has been serviced or replaced. Use an alignment machine to check the wheel turn angle. See the measurement procedure of the alignment machine manufacturer.

The steering stop bolt on the steering knuckle controls the maximum turn angle. If the stop bolt is missing, bent, or broken; replace the stop bolt(s) or jam nut(s) and follow the procedure below for adjustment. Inspect other suspension components for damage.

⚠ CAUTION

In power steering systems, the hydraulic pressure should relieve or "drop off" when the steered wheels approach the steering stops in either direction. If the pressure does not relieve, the components of the front suspension may be damaged.

If the steering stop bolts are adjusted to reduce wheel turn angle, the steering gear poppet valves will require readjustment. If the poppets are not re-adjusted properly, then the steering gear will not reduce power assist properly and steering components will be damaged. Refer to ZF Steering Gear Service Manual for readjusting the poppets.

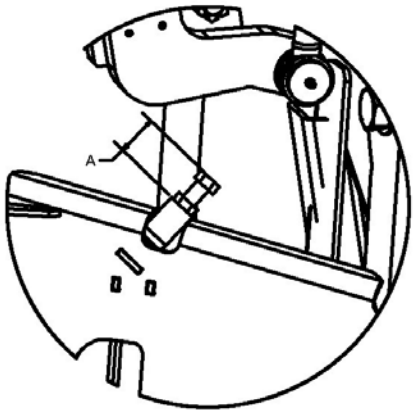


Figure 12 - Steering Stop Bolt

Unit	Steering Stop Length "A"
IFS1000WF	1.75"

1. Drive the front tires on a suitable device that allows the front wheels to turn and measures the wheel turn angle.

NOTE

Unequal toe-in side to side or an out-of-center steering gear can result in unequal turn angles and steering pull while steering straight ahead. The Crank Rod length may be adjusted to attain steering gear on center condition while maintaining equal toe-in side to side. Do not adjust the length of the Crank Rod or Tie Rods to center the steering wheel. This can cause the steering gear to become off center.

2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

3. Check that the steering gear is centered and the tires are steered straight ahead with equal toe-in side to side. If either of these two conditions is not met, then adjust toe-in first before centering the steering gear. See Adjusting the Toe-In Section and refer to pitman arm center mark alignment info.

4. Check that the lengths of the outer tie rods are equal to each other within 1/8 inch. If not, adjust lengths according to the adjusting the toe-in section before adjusting the steering stops.

5. Turn the steering wheel until the steering stop bolt contacts the knuckle carrier or the steering wheel stops turning. Measure the turn angle of the wheel on the same side as the direction of turn.

6. If the wheel turn angle differs then adjust as follows.

7. Loosen the jam nut on the stop bolt.

8. Turn the stop bolt until the specified wheel turn angle is achieved and the bolt head contacts the knuckle carrier.

9. Tighten the jam nut to **50-75 ft-lb** (See Torque Table).

⚠ CAUTION

After readjusting the steering stop(s) check that the steering poppets are reset properly and that the front tires do not contact the frame, suspension, or body. Also check that other components are not abnormally contacting one another.

10. Repeat checking and adjustment for turning the opposite direction. (See Figure 12)

Inspection before Alignment

See the General Inspection section and check the following before conducting front wheel alignment measurements.

Wheels and Tires

1. Check that the front tires are inflated to the appropriate pressure based on the tire loading.
2. Check that the front tires are the same size and type.
3. Check that the wheel and tire assemblies are balanced.
4. Check that all the Wheel Nuts are tightened to the specified torque of **450-500 ft-lb** (See Torque Table).

Front Suspension

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to the specified height.
3. Check for worn ball joints, tie rod ends, steering arm assembly bearings, control arm bushings, knuckle carrier bearings, and damaged suspension components. Replace worn components as needed.

4. Check for loose ball joint and tie rod end tapered connections, tie rod end jam nuts, steering arm assembly mounts, and chassis steering system components. Inspect connections for wear and replace as needed. Tighten connections as needed.
5. Check the wheel bearing adjustment and adjust as needed.
6. Inspect the shock absorbers for wear and damage.

Rear Axle and Suspension

Front tire wear and incorrect steering can be caused by the rear axle and/or suspension.

1. Check that all fasteners are tightened to the specified torque.
2. Check the suspension ride height and adjust as needed to specified height.
3. Check that all connection joints between the suspension and axle are secure.
4. Check for worn suspension bushings or damaged suspension components.
5. Check that the rear axle is correctly aligned.
6. Check that the frame is not bent.
7. Refer to any additional recommendations and specifications from the manufacturer of the chassis on rear axles and suspensions.

NOTE
Total vehicle alignment is recommended when aligning the front suspension.

Front Wheel Alignment

Equipment

ReycoGranning® recommends that suitable alignment equipment be used to measure the wheel alignment characteristics: camber, caster, and toe-in. The alignment equipment must be properly calibrated for accurate measurements. Only qualified personnel should conduct the wheel alignment measurements.

General

The overall toe-in of the front wheels should be checked every 24,000 miles or 2 years. When the vehicle does not steer correctly or the front tires develop an abnormal tire wear pattern, the camber, caster, and toe-in should be measured and adjusted as needed. Toe-in typically has the largest effect on tire wear.

The maximum wheel turn angle should be checked and adjusted as needed.

Shims between the upper control arm mounts are used for additional adjustment of camber. Add and remove as needed. The ray align on the upper control arm will adjust castor to minimize drifts or pulls to one side of the road.

Preparation

1. Follow the alignment equipment manufacturer's procedures for preparing the vehicle for front and rear wheel alignment measurements.
2. Secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement.

NOTE

An out-of-center steering gear can result in unequal wheel turn angles. The steering gear should remain centered during toe-in adjustment. Do not adjust the length Tie Rods to center the steering wheel. This can cause the steering gear to become off center.

3. Check that the steering gear is centered when the tires are steered straight ahead (i.e. equal toe-in side to side). Center the steering gear according to the pitman arm center marks on the steering box.
4. Measure and record the individual wheel camber, caster, and toe-in of the front suspension. Also measure and record the cross camber cross caster, and overall toe-in.
5. If adjustment to camber and caster is required then follow the steps below. Otherwise, go to the "Adjusting the Toe-In" section to adjust the toe-in as needed.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

6. Raise the vehicle until the front wheels are off the ground. Support the raised vehicle with safety stands.

Adjusting the Camber Angle

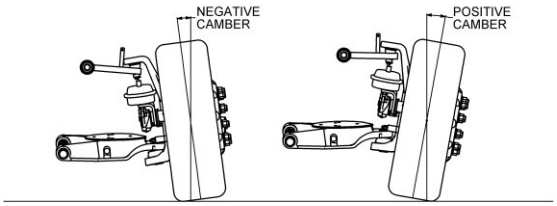


Figure 13 – Camber Angle

> **⚠ CAUTION**
>
> **Do not alter components to adjust the camber.**

Camber is the angle of the wheel with respect to the ground as viewed from the front or rear of the vehicle (**Figure 13**). Camber is positive when the distance between centers of the front wheels at the top is greater than the distance at the ground.

Wheel Camber Angle is affected by the ride height of the suspension. If the ride height is set too high, then the camber measurement will be more positive. See the inspecting and adjusting suspension ride height sections before measuring camber. The table below lists the recommended camber angles.

Upper Control Arm Camber Adjustment

To adjust camber the upper control arm mounts will need to be loosened and shims will need to be added or removed depending if positive or negative adjustment is needed.

Nominal Camber Values-Degrees		
	Unloaded	Loaded
Left	+1/4°(±1/4°)	+1/4°(±1/4°)
Right	+1/4°(±1/4°)	+1/4°(±1/4°)

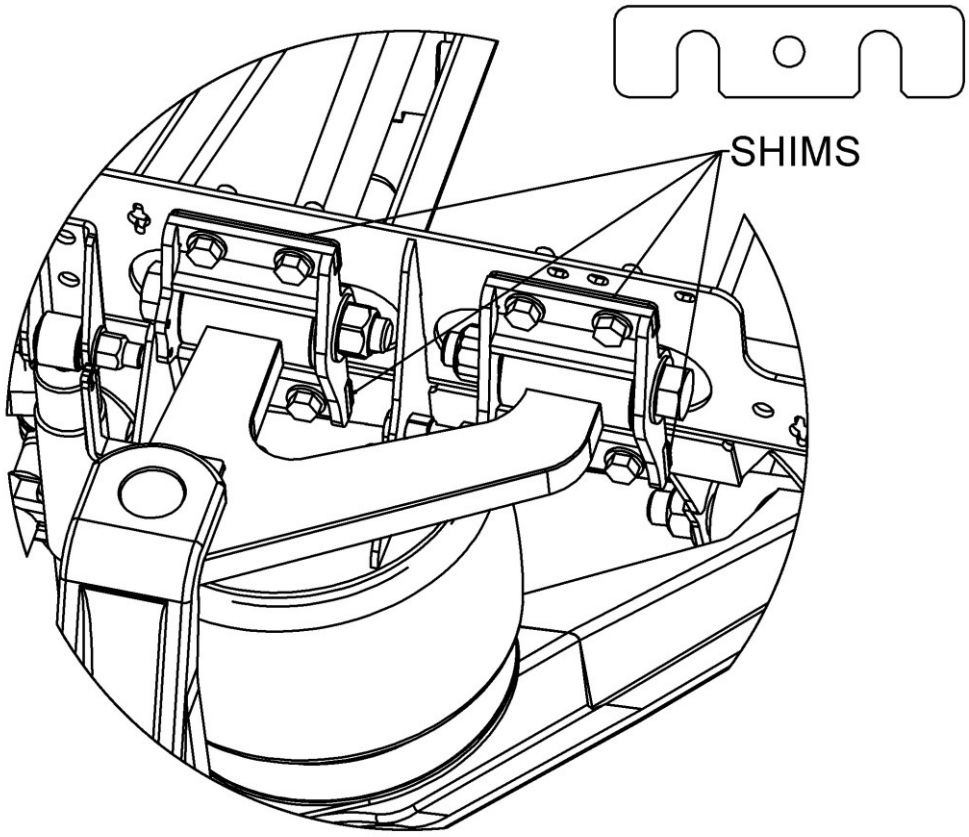


Figure 14 – Upper Control Arm Camber Adjustment

1. Loosen both upper control arm mounts. DO NOT REMOVE BOLTS. This will allow shims to be removed or added. (See Figure 14)
2. Adding shims will make a positive adjustment and removing shims with make a negative adjustment.
3. Once adjustment is made and set re-torque all upper control arm bolts and nuts to 190 ft-lb.
4. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
5. Re-measure the camber and readjust as needed.

NOTE: Adding shims increases camber. Removing shims decreases camber.

Adjusting the Caster Angle

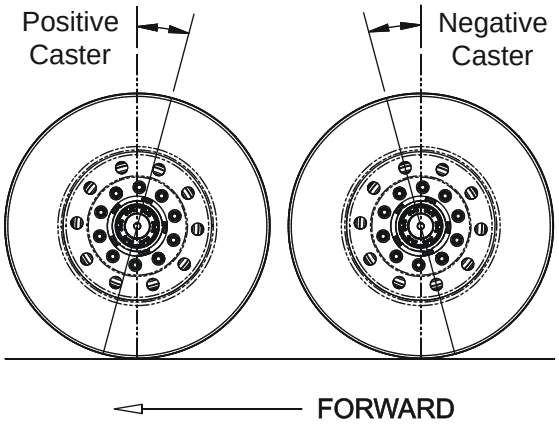


Figure 15 – Caster Angle

The caster angle is the angle between a vertical axis and the axis defined by the king pin when viewed from the side of the vehicle. (Figure 15) When the king pin axis appears rotated clockwise relative to the vertical axis, then the caster is positive. Positive caster creates a self-aligning moment to stabilize the vehicle when driving straight ahead The caster angle is indirectly measured from the change in wheel camber as the wheel is turned through a prescribed turn angle. Therefore, the calculated caster is affected by the ride height of the suspension. See the inspecting and adjusting suspension ride height sections before measuring caster. The table below lists the recommended caster angles.

Nominal Caster Values-Degrees		
	Unloaded	Loaded
Left	+3°(±1/2°)	+3°(±1/2°)
Right	+3°(±1/2°)	+3°(±1/2°)

Upper control arm Caster adjustment

The Castor is adjusted by using the rey-align bolt located on the upper control arm. SEE FIGURE 16 for detail.

⚠ CAUTION

Do not adjust the suspension ride height or alter components to adjust the caster.

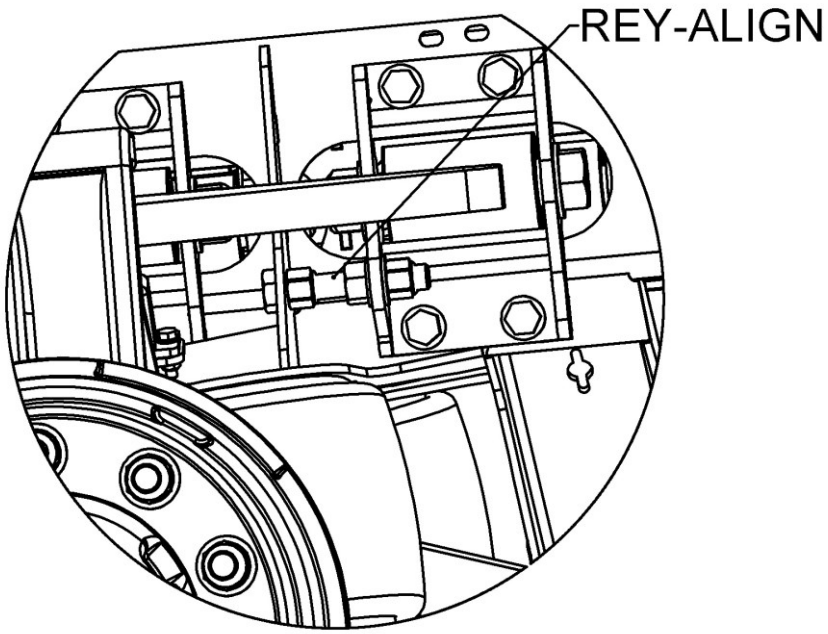


Figure 16 – Eccentric Caster Adjustment

Note: Movement of upper control arm towards rear will increase caster.
Movement of upper control arm towards front will decrease caster.

1. Loosen both upper control arm mounts. DO NOT REMOVE BOLTS.
2. Loosen jam nuts on rey-aligner and adjust to correct caster values.
3. Re-torque rey-align bolt and nut to 350 ft-lb.
4. Re-torque upper control arm mounts to 190 ft-lb.
5. Remove the jack stands and lower vehicle completely. Check that the suspension is at the proper ride height.
6. Re-measure caster and readjust as needed.

Adjusting the Toe-In

CAUTION

Do not alter components to adjust the toe-in.

CAUTION

Improperly oriented tie rod clamps can cause binding in the suspension steering system.

Wheel toe-in is the relationship of the distance between the centers of the front and rear of the front wheels. When the front distance is less than the rear distance, the wheels are "toed-in". Toe-in is designed into the suspension to counteract the tendency of the tires to toe-out when the vehicle is driven straight ahead. Incorrect toe-in can result in rapid tire wear.

1. Measure the length of the outer tie rods. Reference length is 17 inches.
2. If the lengths of the outer tie rods are not within 1/8 inch of each other, then adjust their lengths such that they are within 1/8 inch of each other. Loosen the tie rod clamps on each end of the tie rod and turn the center tube to change the length.
3. Adjust the length of both outer tie rods equally such that the toe-in on each side is 1/16" ± 1/32" and the overall toe-in is 1/8" ± 1/16". Tighten tie rod clamp nuts to **50-60 ft-lb** (See Torque Table).

General Procedures

Repair or reconditioning of front suspension components is not allowed. Components that are damaged or worn must be replaced. Several major components are heat treated and tempered.

⚠ WARNING

The components cannot be bent, welded, heated altered, or repaired in any way without reducing the strength or life of the component and voiding the warranty.

The following operations are prohibited on front suspension components.

1. Welding of or to the steering knuckles, control arms, steering arm assemblies, knuckle carrier, tie rod assemblies, the brakes, the hubs, and the brake rotors.
2. Hot or cold bending of the steering knuckles, control arms, steering arm assemblies, knuckle carrier, tie rod assemblies, ball joints, and the sub-frame except control arm and steering arm assembly mounts which may be cold bent to facilitate bushing and bearing replacement.
3. Drilling out control arm and steering arm assembly mounting holes and ball stud tapered holes.
4. Spray welding of bearing diameters on the steering knuckle spindle, steering arm assembly bores and pivot tube. Spray welding of ball studs or tapered holes for the ball joint and tie rod ends.
5. Milling or machining of any component except that control arm bushing bores may be honed to remove any burrs.

⚠ WARNING

Never work under a vehicle supported by only a jack(s). Jacks can slip or fall over and cause serious personal injury. Always use safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle. Lower control arms are not stationary components and could move allowing the vehicle drop causing serious personal injury.

The vehicle may be supported on safety stands by the suspension sub-frame or chassis frame for repairs that require removal of the wheel and tires or deflation of the air springs. Always secure the vehicle by setting the parking brake and block the drive wheels to prevent vehicle movement before performing repairs.

Cleaning the Parts

⚠ WARNING

If you use cleaning solvents, hot solution tanks or alkaline solutions incorrectly, serious personal injury can occur. To prevent injury, follow the instructions supplied by the manufacturer. Do NOT use gasoline to clean parts. Gasoline can explode.

Ground or Polished Parts

Use a cleaning solvent to clean ground or polished parts and surfaces. DO NOT clean ground or polished parts with hot solution tank or with water, steam or alkaline solutions. These solutions will cause corrosion of the parts.

Rough Parts

Rough parts can be cleaned with the ground and polished parts. Rough parts also can be cleaned in hot solution tanks with a weak alkaline solution. Parts should remain in the hot solution tanks until they are completely cleaned.

Drying

Parts must be dried immediately after cleaning. Dry all parts with clean paper or rags, or compressed air. Do not dry bearings by spinning with compressed air.

Preventing Corrosion

Apply light oil to cleaned and dried parts that are not damaged and are to be immediately assembled. Do NOT apply oil to the brake pads or the brake rotors. If the parts are to be stored, apply a good corrosion preventative to all surfaces and place them inside special paper or containers that prevent corrosion. Do NOT apply corrosion preventative to the brake pads or the brake rotors.

Replacing Tie Rod Ends

Removal

1. Remove the cotter pins from the tie rod end ball stud(s).
2. Remove the castle nuts from the tie rod end ball stud(s).

⚠ CAUTION

Do not strike the component mating taper directly with a steel hammer. Parts can break and cause serious personal injury. Wear eye protection.

3. Disconnect the tie rod end ball stud from the mating component tapered hole using a suitable tool.
4. Inspect the tie rod end ball stud and mating component tapered hole(s). Replace components with worn tapered hole(s). If the grease seal is damaged during removal, replace it before installation.

Installation

1. Clean the mating component tapered hole(s) of any contamination. Insert the tie rod end ball stud into the tapered hole and secure it with the castle nut.

⚠ CAUTION

Tighten the castle nuts to the specified torque. If the castle nuts are not tightened to the specified torque, the parts will be damaged and serious personal injury may occur.

2. Tighten the castle nut to **90-100 ft-lb** (See Torque Table).
3. Install the cotter pins. If necessary, tighten the castle nut to align the hole in the ball stud and slots in the castle nut. Do not loosen the castle nut to install the cotter pin.
4. Lubricate tie rod end as needed.

Replacing the Idler Arm Bearings

Replace the idler bearings in sets. The replacement bearings should be installed by pressing on the outer raceway only. Pressing on the inner raceway will damage the bearing.
The inner grease cavity of the steering arm assemblies should be cleaned when the bearings are replaced.

Removal

1. Follow the procedures for removal of the center rod, pitman arm, and idler arm.
2. Follow the procedures for removal of tie rod ends for the idler arm.
3. Remove the pivot bolts that mount the idler arm. Remove them from the sub-frame.
4. Remove the retaining rings from the pivot sleeve and remove the sleeve. A rubber or brass hammer may be used to remove the sleeve. Retain shims.
5. Support the steering arm assembly bearing housing and press the bearing out of each end.

Installation

1. Clean out the steering arm assembly grease cavity.
2. Inspect steering arm assembly bearing housing bores and remove burrs by honing. Replace steering arm assembly if the bore is damaged.
3. Pack the steering arm assembly bearing with grease.
4. Support the steering arm assembly bearing housing and press the bearing into each end. The seal side of the bearing should face out.
5. Inspect the pivot sleeve and remove burrs with emery cloth.
6. Install one retaining ring onto pivot sleeve.
7. Insert the pivot sleeve into the lower bearing. Use a rubber mallet or similar tool to drive the inner sleeve into the bearings such that the bottom-retaining ring is seated against the bottom inner race. Do not use a steel hammer to install the sleeve because bearing raceways can be damaged.
8. Install upper retaining ring. Reseat lower retaining ring against the lower inner race as needed.
9. Determine the number of shims needed by stacking the shims and placing the stack between the upper retaining ring and inner race until a snug fit is achieved. Remove one shim from the stack and this is the number of shims needed. A maximum of six shims may be used.
10. Remove the upper retaining ring, install the shims determined in step 9 onto the inner sleeve at upper inner race, and re-install the upper retaining ring. Check that upper retaining ring is properly seated in the groove of the inner sleeve.
11. Place the steering arm assembly in its mount and install the pivot bolt. Tighten the pivot bolt lock nut to **575-625 ft-lb** (See Torque Table).
12. Follow the procedures for installation of the Relay Rod or tie rod.

Replacing the Upper and Lower Control Arm Bushings

The subframe control arm mounts may require widening to accommodate

replacement bushings. The width may be increased by inserting a suitable jack between the bushing mounts and cold bending the mounts. Care must be taken to not exceed 5.00" width after widening.
The control arm mounts should be inspected for damage.
Both control arm bushings and mounting fasteners must be replaced in a control arm when bushings are serviced.
ReycoGranning® recommends replacing the control arm bushings and mounting fasteners in all of the control arms at the same time.
The control arm housings must be properly supported during bushing removal. The bores of the control arm housings may be honed to remove any burrs.
If the control arm is to be separated from the steering knuckle, follow the removal and installation procedures in the "Replacing the Ball Joint" Section.

CAUTION: Use of a cutting torch to remove control arm bolts will permanently damage control arm bushings and can result in damage to subframe.

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

2. Raise the vehicle until the front wheels are off the ground. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.
3. Remove the tires and check that the air springs are deflated.

Upper Control Arm

1. Disconnect height control valve linkage from the upper control arm. Follow the removal procedure in "Replacing the Height Control Valve" Section.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

2. If desired, disconnect the upper control arm from the steering knuckle. Follow the removal procedure in "Replacing the Upper Ball Joint" Section.
3. Loosen and remove the control mount arm bolts. Remove any existing eccentric components. Note the orientation of the set screws for reinstallation.
4. Press the bushing out of the control arm housing. Be sure to properly support the housing.
5. Inspect the housing bores and remove any burrs in the housing by honing.
6. Press the bushing into the control arm housing. Be sure to properly support the housing.
7. Place the control arm in its mount location. If not equipped with eccentrics, install the control arm

mount bolts into subframe snug tight and skip to step 15.

8. Place the spacer into the bushing.
9. Insert an eccentric adapter on each end of the upper control arm mounting plate.
10. Place bolt and washer through the spacer and bushing as shown.
11. Install washer and locking nut.
12. Repeat the process for the rear upper control arm mounting bolt.
13. Rotate the eccentric adapters on the front mounting bolt, such that the set screws are located as previously orientated.
14. Vehicle alignment may have to be checked. Please refer to Section 5. When the eccentric adapters are properly oriented, tighten the bolts.
15. Support the control arm such that it is at ride height and tighten the bolts to **950-1050 lbf•ft**. (without eccentrics) or **460-490 lbf•ft**. (with eccentrics). See Torque Table.
16. Install and tighten the set screw on any eccentrics installed to **30-40 lbf•in.** Refer to Torque Table.
17. Reconnect the steering knuckle to the control arm if disconnected. Follow the installation procedure in "Replacing the Upper Ball Joint" Section.
18. Reconnect the height control valve linkage. Follow the installation procedure in "Replacing the Height Control Valve" Section.

Lower Control Arm

1. Disconnect the lower shock mount from the lower control arm. Follow the removal procedure in "Replacing the Shock" Section.

WARNING: The steering knuckle is heavy and unevenly balanced. Use a portable crane or suitable jack to support it prior to disconnecting it from the control arm or removing the control arm with the steering knuckle attached.

2. If desired, disconnect the lower control arm from the steering knuckle. Follow the removal procedure in "Replacing the Lower Ball Joint" Section.
3. Loosen and remove the control mount bolts.
4. Press the bushing out of the control arm housing. Be sure to properly support the housing.
5. Inspect the housing bores and remove any burrs in the housing by honing.
6. Press the bushing into the control arm housing. Be sure to properly support the housing.
7. Place the control arm in its mount location. Install the control arm mount bolts into subframe snug tight.
8. Support the control arm such that it is at ride height and tighten the bolts to **950-1050 lbf•ft**. See Torque Table.
9. Reconnect the steering knuckle to the lower control arm if disconnected. Follow the installation procedure in "Replacing the Lower Ball Joint" Section.

10. Reconnect the lower shock mount. Follow the installation procedure in “Replacing the Shock” Section.

Replacing Wheel Bearings, Oil Seals, and Hub Caps

Preparation

1. Set the parking brake and block the drive wheels to prevent vehicle movement.
2. Raise the vehicle until the front wheels are off the ground. See jacking instructions. Support raised vehicle with safety stands. Do not place jacks or safety stands under the lower control arms to support the vehicle.

WARNING: Never work under a vehicle supported by only a jack. Jacks can slip or fall over and cause serious personal injury. Always use safety stands.

3. If the wheel nuts have chrome covers, remove them with special pliers equipped with plastic non-marring jaws. Place them in a container to prevent damage or loss.
4. On aluminum wheels, place a plastic anti-scuff guard over the wheel nuts and loosen the wheel nuts. On steel wheels, remove the hub cap nuts if present and the hub cap before loosening the wheel nuts. Place the hub cap in safe location to prevent damage. Place the wheel and/or hub cap nuts in a container to prevent contamination or loss.
5. Remove the wheel and tire assembly and place it aside. Mark the tire to ensure it can be identified for installation on same side as removed.
6. Remove the brake drum and place it aside. Mark the brake drum to ensure it can be identified for installation on same side as removed.

Removal

1. Place an oil drip tub beneath the hub to catch oil. Rotate the hub such that the hubcap drain plug is facing upwards. Remove the drain plug from the hubcap and place it in a container for re-installation.
2. Rotate the hub such that the drain hole faces downward and drain the oil from hub cavity. Wait a few minutes for most of the oil to drain before continuing to the next step.
3. Remove the hub cap bolts, hub cap, and gasket. Take care not to damage the gasket for re-installation. Place the components in a location to prevent contamination. Note that the hub cap window may be damaged by solvents. Skip to step 5 for Ax-Lock hub.

NOTE: When removing or installing the inner and outer spindle nuts, use the correct wrench sockets to avoid damaging the nuts. Do not use impact driver to tighten inner and outer nuts. Only use a torque wrench to tighten the nuts.

4. Unbend the spindle washer and remove the spindle outer nut, spindle washer, locking “D” washer, and the inner spindle

nut. Retain all components for re-assembly except discard the spindle washer.

5. For Ax-Lock use 2 1/8" socket to remove hub nut and continue with step 6.
6. Place a shop towel on top of the lower brake shoe to prevent oil from dripping onto the brake lining.
7. Tug sharply on the hub to unseat the outer bearing without completely removing the hub. Wipe up any oil spilled on the brake assembly as quickly and completely as possible. Remove the outer bearing and place it in a container to prevent contamination.
8. Remove the hub from the spindle and place it on the floor with its stud side facing downwards. Protect the wheel studs from damage. Wipe the excess oil off spindle with a clean shop towel to prevent oil dripping onto the brake assembly. If oil saturates or significantly contaminates the brake lining then replace the lining.
9. Remove the hub seal and discard it. Inspect the axle ring on the spindle and remove it if worn.
10. Inspect the inner cup (outer bearing race for the inner bearing) and outer cup in the hub for damage. Replace the inner cup if damaged.

Installation

1. Remove the axle ring from the replacement hub seal assembly P/N 7977 if the axle ring is not removed from the spindle. Note axle ring orientation. Place the hub seal onto the axle ring with the ribbed rubber side facing the flange of the axle ring. Seat the hub seal firmly against the axle ring flange. If the axle ring is removed, install the hub seal assembly with appropriate seal installation tool. (Reference Stemco P/N 555-5098)

NOTE: Do not drive bearing onto spindle with a steel hammer or similar instrument. Inner race is a tight slip fit with spindle.

2. Place the replacement inner bearing P/N 1784 onto spindle with small end of taper facing outward. Seat the inner race against the step of the spindle.
3. Press the ABS sensor outward about ¼". Do not use a sharp tool on lead wire end of the sensor. See section 3 for the inspection of ABS sensor as needed.
4. Place the hub onto the spindle until it seats on the inner bearing. Do not "ram" the hub onto the seal.
5. Place the replacement outer bearing onto the spindle until it seats on the outer cup in the hub. The inner spindle nut may be used to guide the bearing onto the spindle. The hub should be supported to prevent misalignment and binding. For Ax-Lock hub skip to step 13-16.
6. Install the inner spindle nut and tighten hand tight.

7. Seat the bearings by tightening the inner spindle nut to **180 lbf•ft** while rotating the wheel in both directions.
8. Rotate the hub and drum ten (10) complete revolutions.
9. Loosen the inner spindle nut completely and then re-tighten the inner nut to **20 lbf•ft**.
10. Back off the inner spindle nut ¼ turn.
11. Install the spindle locking "D" washer.

NOTE: If the dowel pin of the inner spindle nut and a hole in the locking washer are not aligned, turn the locking washer over and re-install. If required, loosen the inner spindle nut just enough for alignment.

CAUTION: Never tighten the inner spindle nut to align the dowel pin with hole in locking washer. This can pre-load the bearings and cause premature bearing failure.

12. Install the replacement spindle washer P/N 6969 and the outer spindle nut. Tighten the outer spindle nut to **200-300 lbf•ft**. See Torque Table for sequence.
13. Place 2-4 Drops of oil on spindle threads. Align retainer cage tab ("D" flat) on locking spindle nut with "D" flat on spindle. Rotate socket by hand clockwise until locking spindle nut contacts outer bearing in hub assembly. Do not use powered tool to run bearing down against bearing. If locking spindle nut will not rotate freely on spindle, nut may be cross threaded. Rotate counter clockwise until threads disengage. Repeat locking spindle nut installation.
14. Rotate hub assembly back and forth while tightening locking spindle nut to final torque of 300 ft-lb.
15. Remove socket and verify locking clip tabs have engaged the adjustment slots in retainer cage on locking spindle nut.
16. Measure end play between hub assembly and spindle with dial indicator. Acceptable end play between hub and spindle is .000-.006 inches.
17. Attach a dial indicator with a magnetic base to the face of the hub. (See Figure 17). Note the brake drum is shown for reference only.
18. Place the tip of the dial indicator on the center of the steering knuckle spindle. Set the dial indicator on zero.

NOTE: Do not push/pull at the top and the bottom of the hub. Pushing or pulling at the top and the bottom will not yield a true measurement of the end play.

15. Measure the end play by simultaneously pushing/pulling on each side of the hub while observing the dial indicator. The end play is the <u>*total*</u> travel observed. If the end play is not within .001-.004 inch re-adjust the wheel bearings per steps 7-11. Otherwise continue to step 16.

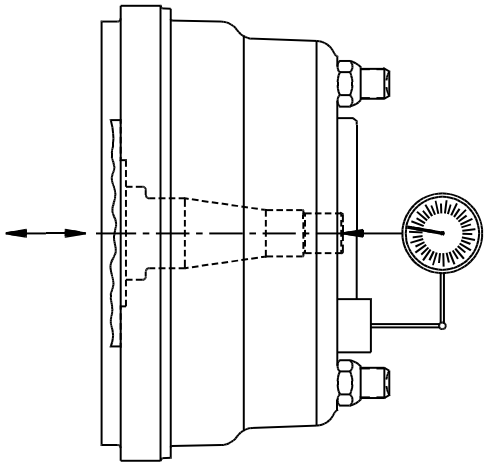


Figure 17 - Wheel End Play Measurement

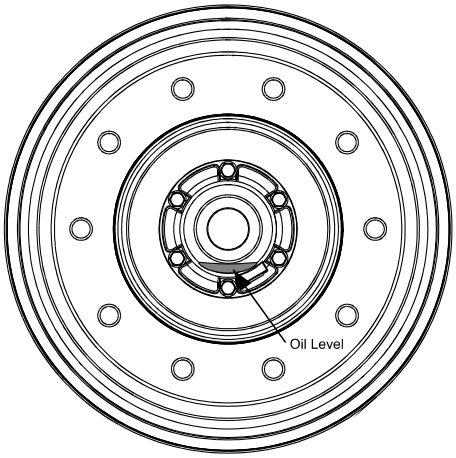


Figure 18 - Wheel Bearing Oil Level

16. Bend the spindle washer over one wrench flat of the outer nut.
17. Install the hub cap gasket and hub cap. Tighten the cap screws to **20-30 lbf•ft**. See Torque Table for sequence.
18. Fill the hub cavity with the appropriate amount(approx ½ pint) and type of lubricant(90W gear oil).
19. Check oil level through the hub cap window. (See Figure 18). If level is below the "add" level line, then fill with recommended oil until "full" level is achieved. Add oil slowly since the heavy weight oil will settle slowly in the hub. (Note: The hub cap window can only be cleaned with mild soap and water. Aromatic solvents should not be used as they will impair the transparency of the window.)
20. Install the hub cap drain plug.
21. Check the hub cap for external oil leakage at the drain plug or gasket. For leaks at the drain plug check for application of thread sealant to threads and tightness. For leaks at the gasket, replace the gasket. The vent plug will normally weep a small amount of oil.
22. Install the brake drum.
23. Install the wheel and tire assembly and the wheel nuts.
24. On aluminum wheels, use a plastic anti-scuff guard over the wheel nuts. Tighten the wheel nuts to **450-500 lbf•ft**. See Torque Table for sequence.
25. Replace the hub cap nuts and hub caps if removed to service the wheel bearings.
26. Remove jack stands and jacks

Replacing Brake Components

Brake Drums

The brake drums should be replaced if they are damaged or exceed the drum manufacturers recommended maximum diameter or runout specification. Refer to manufacturer brake drum guidelines for inspection and specifications.

Automatic Slack Adjuster

The automatic slack adjusters are not serviceable and should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the automatic slack adjuster.

Brake Chambers

The brake air chambers should be replaced if damaged or malfunctioning. Refer to manufacturer guidelines for correct function of the brake air chambers.

Other Brake Components

The brake shoe linings should be replaced when they are worn beyond the manufacturers limits. When the brake linings are serviced, other components such as the S-cam rollers and return springs should also be serviced. Refer to the brake manufacturers guidelines for servicing the brakes.

Replacing the ABS Sensor and Tone Ring

The anti-lock brake system (ABS) of the vehicle should be diagnosed by a qualified technician before the anti-lock brake sensor or the tone ring is replaced. Replacement parts must be equivalent to the vehicle manufacturers to ensure proper function of the anti-lock brake system. The anti-lock brake sensor and tone ring cannot be repaired and must be replaced if damaged or malfunctioning.

Sensor Removal

1. Remove the Brake Caliper to provide access to sensor.
2. Press sensor out of steering knuckle. Do not pull sensor out by its lead wire.
3. Remove tie straps that secure the sensor lead wire and disconnect the sensor lead wire from the chassis wire harness.

Sensor Installation

1. Check that the sensor bushing is properly seated in the steering knuckle and the sensor spring retainer is seated properly in the sensor bushing.
2. Press the sensor into the steering knuckle until the sensor end contacts the tone ring.
3. Connect a volt meter to the connector pins of the sensor lead wire. Set the volt meter to read AC voltage on a scale of 0-10V.
4. Spin the hub by hand and read the voltage output of the sensor. A minimum reading of 0.8V AC is normal. Skip to step 8 if minimum reading is obtained.
5. If the minimum reading is not obtained then check the volt meter connection and proximity of the sensor and tone ring. The air gap between the sensor and tone ring should not exceed .027”. Repeat step 4.
6. If the minimum reading is not obtained, check the tone ring for damage and its installation. The tone ring should have a maximum run out of .008”. Replace as needed and repeat step 4.

7. If the minimum reading is still not obtained, then replace the sensor and repeat the installation procedure.
8. Route and secure the sensor lead wire the same as the removed sensor.
9. Connect the sensor lead wire to the chassis. Secure wire lead to prevent damage during suspension movement.

Tone Ring Removal and Installation

Follow the hub manufacturer's guidelines for removal and installation of the tone ring.

Replacing the Shock Absorber

⚠ CAUTION

The shock absorber is gas pressurized and must not be punctured or be subjected to excessive heat which can result in serious personal injury. The shock will expand to its full extended length if not restrained.

Removal

1. Remove the lower shock thru bolt mounting hardware and retain for installation. Do not remove the lower shock mount bracket from the lower control arm.
2. Remove upper shock bushing mounting hardware and retain for installation. Note location and quantity of washers and spacers.

Installation

1. Loosely attach upper shock bushing to sub-frame with mounting hardware (spacers on forward side of shock).
2. Position shock in suspension such that the thru bolt is connected to the lower shock mounting bracket tabs.
3. Tighten lower thru mounting bolt and nut to **170-190 ft-lb (**See Torque Table). Tighten lower shock bracket mounting bolts to **30-40 ft-lb** (See Torque Table).
4. Tighten upper mounting nut to **170-190 ft-lb (**See Torque Table).

Replacing the Air Spring

The correct air spring must be installed. The use of a substitute air spring is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

Removal

1. Deflate the air spring by disconnecting one end of the vertical HCV linkage from the horizontal arm. Rotate the horizontal HCV arm downward and secure it in place.
2. Disconnect the airline at the air spring inlet port and remove the connection fitting from the inlet port.
3. Remove the bolts and washers from the upper air spring mount studs. Note location of bolts and washers.
4. Remove the bolts that secure the air spring to the lower air spring mount.

Installation

1. Attach air spring to upper air spring mount. Note that the shorter bolt is located towards the front. Tighten mounting hardware snugly.
2. Attach air spring to lower air spring mount. Tighten lower mounting bolts to **20-30 ft-lb** (See Torque Table).

3. Tighten the upper mounting bolts to **15-20 ft-lb** (See Torque Table).
4. Apply Permatex or equivalent thread sealant to the threads of the air connection fitting and install the fitting.
5. Connect the airline to the fitting.
6. Inflate the air spring by un-securing the HCV horizontal arm and reconnecting the vertical linkage to it.
7. Check the airline and fitting for air leaks.

Replacing the Height Control Valve

The correct height control valve (HCV) must be installed. The use of a substitute HCV is not allowed and may cause unequal load sharing between the air springs and cause adverse ride and handling characteristics.

NOTE
Lower control arm may move downward due to the internal gas charge in the shock absorber. A portable jack may be needed to align the lower control arm with the knuckle carrier bar pin.

Removal

1. Drain the air from the supply reservoir on the chassis connected to the front suspension.
2. Disconnect the vertical HCV linkage from the horizontal arm.
3. Mark airlines and connections for re-assembly. Disconnect the airlines from the HCV. If any other plumbing fixtures are connected to the HCV, mark them for re-assembly.
4. Remove the HCV mounting hardware from the sub-frame.
5. Remove any other air fittings or plumbing fixtures from the HCV.

Installation

1. Apply Permatex or equivalent thread sealant to the threads of the air connection fittings or plumbing fixtures and install the fittings or plumbing fixtures in the HCV.
2. Attach the HCV to the sub-frame with mounting hardware. Orient the horizontal arm horizontally and tighten the mounting nuts to **7-9 ft-lb** (See Torque Table).
3. Connect airlines as marked during removal.
4. Connect the vertical linkage to the horizontal arm.
5. Recharge system with air and check for air leaks.
6. Check the ride height and adjust per section on adjusting the ride height as needed.

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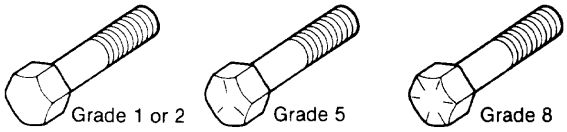
Torque Tables

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load, and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.



Grade Markings on Bolts

Grade	Lock Nut Grade B, F	Lock Nut: Grade C, G
Identification	3 Dots	6 Dots

Grade Markings on Lock Nuts

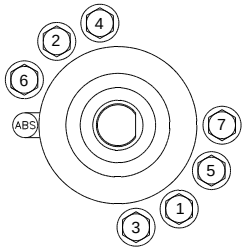
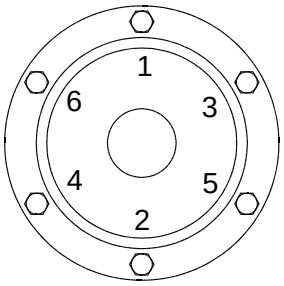
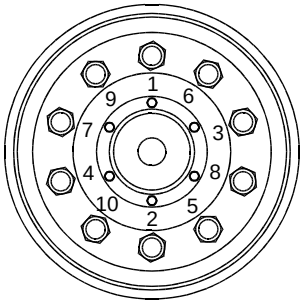
Torque Table 1

Applications	Fastener Size	Torque Specification (ft-lb) (Clean and Dry)
Upper Control Arm Bushing Pivot Bolt	1-1/8-12 x 7.5 Gr 8	950-1050(1)
Lower Control Arm Bushing Pivot Bolt	1-1/8-12 x 7.5 Gr 8	950-1050(1)
Lower Steering Knuckle Ball Joint Nut Castle Nut	M30 x 1.5	350-360(3)
Upper Steering Knuckle Ball Joint Nut Castle Nut	M20 x 1.5	160-170(3)
Upper Control Arm Mount Brackets	5/8-11 x 2.5 Gr 8	170-190(1)
Air Spring Lower Mount Bolt (into Air Spring)	SFCS 1/2-13 x 1	7-10(2)
Air Spring Locating Bracket	1/2-20 x 5 Gr 8	50-55(2)
Upper Air Spring Mount Nuts	1/2-13 Gr G	25-35(2)
	3/4-16 Gr G	40-50(2)
Steering Gear Mounting Bolts	7/8-9 x 4 Gr 8	325-375(1)
Idler Arm Pivot Bolt	7/8-9 x 8.5 Gr 8	325-375(1)
Tie Rod and Relay Rod Ball Joint Castle Nut	M20-1.5	90-100(3)
Tie Rod Clamp Nut	5/8-11 Grade B	50-60
Upper Shock Eye Mount Lock Nut	3/4-10 Grade C	170-190(1)
Lower Shock Eye Mount Lock Nut	3/4-10 Grade C	170-190
Steering Stop Jam Nut	1/2-20 Grade B	50-75
Pitman Arm Nut	1 1/8-12 Grade C	345-420(4)
Hub Cab Bolts	5/16-18 x 3/4 Gr 5	17-22

1) Torque applied to fastener head
2) Apply thread adhesive Loctite #242 or equivalent to threads of fastener
3) Install cotter pin after properly torquing nut
4) Stake nut to steering gear output shaft.
   a) Locate notch in output shaft
   b) Use punch or dull chisel to drive raised section of pitman arm nut into notch in output shaft.
   c) Take care not to tear raised section of pitman arm nut while staking

Torque Tables

Torque Table 2

APPLICATIONS	FASTENER SIZE	TORQUE SPEC. (ft-lb) (CLEAN AND DRY)	TORQUE SEQUENCE
Torque Plate Mount Cap Screws	5/8-18 Grade 8	170-190	 Driver Side
Hub Cap Bolt	5/16-18 Grade 5	20-30(1)	
Wheel Nut	M22x1.5 (Hub Piloted)	450-500(2) (Dry Threads)	

1) Torque applied to bolt head
2) Recheck Wheel Nut torque after first 50-100 miles

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